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REGIONAL ASSESSMENT OF WETLANDS REGULATION PROGRAMS IN NEW ENGLAND

A Final Report submitted to
The Office of Technology Assessment, United States Congress
by
The Water Resources Research Center
University of Massachusetts
Amherst, Massachusetts
September 20, 1982

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EXECUTIVE SUMMARY

E. R. Kaynor

Introduction

This report responds to the request of the Office of Technology Assessment dated February 17, 1982 for a regional assessment of wetland trends and factors influencing wetland use in the New England Region. The report combines the efforts of 3 teams of researchers covering, respectively, the record of physical wetlands changes, the legal and institutional management programs which have influenced these changes, and the economic factors which have both influenced changes and been themselves altered by such changes.

While the relative success or failure of these research efforts can only be determined by a careful reading of the following detailed report, it would be fair to state that the investigators themselves believe that too little is known about either physical wetlands changes or economic factors in New England to make possible a comprehensive set of firm conclusions about these aspects. However, the region contains a wealth of varying laws and regulatory programs which have made possible a legal and institutional report which provides a full-scale assessment of these programs and offers provocative insights into both the impact these programs have had on wetlands use and the extent to which they offer realistic management options for the future.

In conformance with OTA's request for focal attention on two states in the region, this report features greater detail about wetlands and wetland programs in Massachusetts and Rhode Island than about the other 4 New England states.

Kevin Richardson and Dr. William MacConnell of the University of Massachusetts are primarily responsible for Part I, "Physical Aspects of Wetland Change in New England". Attorney Alexandra D. Dawson and Pamela Harvey are coauthors of Part II, "Legal and Institutional Aspects of Wetland Protection Programs in New England". Dr. Thomas H. Stevens of the University has written Part III, "Evaluation of Economic Factors Affecting Wetland Trends in New England".

SUMMARY OF FINDINGS

1. Physical Wetlands Change.

Panoramic aerial photography of New England's ground cover, topographic features, and water resources has been undertaken for nearly half a century. Because of Dr. MacConnell's pioneering development of aerial photographic techniques and interpretive sciences since mid-Century, Massachusetts and coastal Rhode Island especially have a photographic record of wetland changes over a 30-year period which is unmatched elsewhere. Interpretation of these photographs has led to a proliferation of scientific reports on land use and water resource changes by a generation of research scientists.

Unfortunately, these reports are subject to limitations which reduce their utility as sources of data for analyzing the relationship between physical wetlands change and the impact of wetlands management programs or economic factors on those changes. First are the limitations of the record itself which is subject to interpretive variability, limited with respect to the size of wetland which can be reliably discerned, and limited in large part to those wetlands which can be observed in all

seasons of the year (possibly as little as 40% of all wetlands in New England). Second is the absence of an aerial photographic record which coincides with the institutionalization of wetlands management programs. It was initially felt that a correlation might be made between observable speed of wetlands change in New England and extent to which wetland control programs were instituted by the various states and the federal government. However, both physical change data and management programs are too recent and uncoordinated (in the sense of mutual time-sequencing) to make possible reliable conclusions about this relationship.. Third, the "science" of determining causes of change once they are shown to exist is in its infancy. When a successional change is noted, it is difficult to ascertain whether or not the change occurred because of naturally occurring events (e.g., flood, drought, beaver activity) or man-induced factors (e.g., dredge, fill, drain, pollute). Furthermore, if man's activities appear to be factors, it is not always immediately obvious which of these activities are primarily responsible for aerially-observed changes. Finally, most wetlands scientists have tended to focus their attention on wetlands changes as physical phenomena rather than on the activities of man which impact such changes. Thus, data from the physical record tend to emphasize net gains or losses rather than absolute figures which could yield conclusions about specific activities affecting specific wetlands, whether positively or negatively.

Notwithstanding these limitations there were some important findings obtained from the record of physical wetlands changes in New England.

Among them were the following.

a. Roughly two-thirds of wetlands changes in a representative Massachusetts sample were successional and (presumably) not man-induced.

b. Of man-induced changes over the last 30 years, impoundment, agriculture and agricultural abandonment (including silviculture), highway construction work, commercial and industrial development, and residential property alteration constitute over 90% of changes, roughly in the above order of importance.

c. Because most impoundments were for recreational purposes, it is probable that residential property alteration as a category of change should be ranked higher than indicated above.

d. All of these activities (and others) are capable of altering wetland values either positively or negatively, but outright wetland gains (creation or expansion) are characteristic of the modern trend toward abandonment of agriculture in New England and the consequent plugging of former drainage works. There is often a gain in open wetlands at the expense of some vegetated wetlands losses resulting from impoundments whether created by construction of a dam or highway embankment. And there are clear cases of outright wetland losses resulting from filling and drainage work associated with property alteration and highway construction.

e. Best available sources reveal greatest abuse of wetlands along the coast in prior years, but this trend appears to have slowed considerably, probably (at least in major part) because of

increasing effectiveness of state and federal wetlands protection programs in coastal areas.

f. The inland areas of New England's 3 northern states represent the largest land area in the region but the least well documented with respect to both wetland inventory and wetland change, primarily because of the difficulty of identifying forested wetlands. Since silvicultural activities are known to severely impact wetlands, the recent increase in use of lumber and peat as alternative energy sources could have profound spin-off effects on the wetland ecosystems of northern New England.

g. While supporting data are subject to qualification because of unknown variables, it is probable that outright net losses of wetlands through filling and drainage have not exceeded 5% over the most recent 30-year period.

h. Public policy in a democracy is based, at least in part, on public preferences, and preferences are subject to shifts in public perception and life-styles. It is therefore not possible to draw unequivocal conclusions about wetland values gained or lost through change. However, to the extent that shifts from vegetated wetlands to open water usually entail realization of immediate preferences in exchange for long-term benefits, regulators should view with some alarm the apparent recent increase in successional change, especially in the inland wetlands of southern New England.

The pending completion of the National Wetlands Inventory of the U.S. Fish and Wildlife Service will provide a quantum increase in the availability of reliable, standardized data on wetlands and wetland changes in all regions of the Nation.

2. Legal and Institutional Aspects of Wetland Protection Programs.

Over 150 pages of the following report (a) elaborate upon the present operations of local, state, and federal agencies charged with responsibility for overseeing activities which impact New England's wetlands and (b) provide detailed descriptions of the laws and regulations governing operation of these agencies, the ways in which these agencies interact, and the court rulings in cases of contested authority.

At all three levels of government, the principal mechanism employed to regulate wetland-impacting activity is the device of the legal permit to perform work circumscribed by guidelines, conditions, and/or compensatory requirements. However, other devices are also employed, including field inspection, issuance of cease and desist orders, fines, and legal prosecution of violators.

The federal agency charged with major responsibility for satisfying federal requirements with respect to wetland activities is the U.S. Army Corps of Engineers. In most of New England, this responsibility is assumed by the New England Division of the Corps in Waltham, Massachusetts. The Hudson River drainage basin in portions of extreme western New England is the responsibility of the Northeastern Division of the Corps in New York City. These two divisions operating principally under authority of

Section 404 of P.L. 92-500 (1972) as amended by the Clean Water Act of 1977 are charged with limited responsibility for maintaining wetland values in wetlands of generally large physical dimensions and significant hydrologic parameters. As a matter of legally promulgated procedure, the Environmental Protection Agency, the Fish and Wildlife Service, and the National Marine Fisheries Service comment to the relevant division of the Corps on applications for permits submitted to the Corps for work in, or adjacent to, wetlands. EPA also has enforcement standard-setting powers and can require Environmental Impact Statements. Because of their related objectives, the Federal Emergency Management Agency has some permitting authority over activity in floodplain wetlands and the Coastal Zone Management Agency can set standards which impact wetlands in tidal areas.

In New England, at least, these various federal programs have been generally supportive of state and local efforts to control use of wetlands. Coastal wetland protection programs especially have benefitted from the federal overlay of CZM funding and Corps expertise, derived from over a century of work in rivers and harbors. The federal presence in inland wetlands needs to be strengthened, especially in small, but critically important, upland wetlands (where present federal regulations all but prohibit Corps intervention) and in states with weak or substantially non-existent state and local wetlands control programs (inland Maine and Vermont being the New England areas with least regulatory control).

The three southern New England states (Connecticut, Massachusetts, and Rhode Island), the state of New Hampshire, and coastal Maine all have

legally constituted state wetlands control and permitting programs. Inland Maine and Vermont wetlands sometimes benefit from state regulatory action to control land use in general, but neither state has yet enacted an inland wetlands-specific state law. In all New England states, however, there are local control options available such as zoning and subdivision regulations and floodplain protection bylaws which can and do sometimes serve significantly to limit gross misuse of wetland areas and abutting drainage sources.

The state programs provide interesting contrasts in objectives, jurisdictional prerogatives, manner of operation, and effectiveness. Most states have multiple programs, Rhode Island and Connecticut having separate coastal and inland programs, and Massachusetts having a unique "little NEPA" in the form of a state Environmental Policy Act which can require Environmental Impact Reports along lines similar to EPA's Environmental Impact Statements (applicable in the Massachusetts law to wetlands of from 1 to 9 acres on a discretionary basis and to wetlands of 10 acres or more on a mandatory basis).

In terms of effectiveness, it is difficult to choosebetween systems because each has certain clear advantages and disadvantages, and only Massachusetts and Rhode Island were examined in sufficient detail to provide enough factual support for firm conclusions. In all states (with the possible exception of Maine) state courts have generally moved from early support of development interests toward support for state enacted wetland protection laws and regulations.

Evidence does support a conclusion that of all beneficial aspects of the varying state programs, Massachusetts' delegation of "first crack" jurisdictional prerogatives to local governments has been the most successful programmable advantage encountered in this survey. Physical action impacting wetlands are local actions applied to a local resource, and the well-established public administration axiom of local control of local problems applies. While the state of Rhode Island is small enough to make seemingly feasible a central system of control by state agencies, practical reality does not favor sufficient staff to maintain adequate surveillance of even such a small-sized state; and it is perhaps precisely because of this limitation that Rhode Island has legally exempted small wetlands from permit requirements and annually excuses from formal permit requirements about 90% of all applications through a "preliminary determination" system (discretionary waiver).

On the other hand, Rhode Island appears to make maximum use of all weapons available in the wetland control arsenal, concentrating prodigious effort on inspection of complaints and attempting to obtain corrective action in cases of violation. In the Massachusetts system, most inspection and violation corrective action is taken at the local level where budget allocations for such activities are almost invariably low and political clout is less.

Both Rhode Island and Connecticut also appear to have more comprehensive state wetlands control legislative enactments than Massachusetts, especially in the area of wetland values to be protected. Massachusetts law pays no attention whatever to aesthetics, wildlife, or recreation,

thus forcing regulators who see threats to such values in proposed actions, to couch their denials or orders of condition in highly vague language.

But notwithstanding these limitations in the Massachusetts program, that state's local initiative program has been a great success. The program has been in effect for 10 years. Under the law, local conservation commissions (or other authorized agencies) consider proposals affecting wetlands, issue permits (usually with conditions to minimize adverse impacts or to compensate adverse impacts with positive benefits), or deny them for legally justified cause. Aggrieved parties (petitioners, abutters, concerned citizens, state environmental agency) may appeal a local decision to the state for new consideration. In practice, approximately 10% of local decisions are appealed.

Since wetland values and legal language about them are imprecise and judgmental phenomena, decisions about human activity affecting wetlands are very discretionary. When the Massachusetts local-decision law was passed in 1972, misgivings were expressed about the ability of local citizen appointees with no necessary training or qualifications to make important water resource decisions which might have potentially vital impact on both the local environment and the local economy. However, the law's supporters appear to have been vindicated. Not only have a very small percentage of local decisions been challenged, but upon challenge, most local decisions have been supported by the state. Study personnel expected to find a correlation between type of local conservation commission and category of appellant to the state: developers appealing negative decisions of environmentally-oriented commissions; citizens

or abutters appealing positive decisions of developmentally-oriented commissions. While this hypothesis needs further testing with in depth invesigations of specific local commissions, it appears that, generally, balanced representation on commissions or judgment based on clear local knowledge has blunted any such potential correlation. There does appear to be a higher percentage of appeals by citizens in the western region of the state and by developers, in the coastal areas, but this could be a function of (a) availability of options, (b) clarity of the issues, or (c) size of economic stakes along the coast rather than an inherent conservative outlook in the west or liberal outlook in the east.

Further support for the local decision law comes from the fact that there appears to be an inverse correlation between number of local permit cases and number of appeals. Amherst, for example, with a relatively heavy case load has never had a decision appealed. Apparently on the job training increases the sophistication of subsequent decision-making.

It is sometimes argued that local decisions are seldom appealed because local decision-makers seldom deny a permit outright. Local decisions are hedged to avoid controversy and the onus of forthright action, it is claimed.

This is undoubtedly true, but it is no less true of agencies at higher levels in the state and federal system where outright denial is a rarity. Indeed, it is characteristic of democracy that multiple interests force decision-makers to consider all sides of a question and to make conditional judgments rather than ex cathedra declarations. To challenge

the practice of issuing permits with multiple conditions attached is to challenge the very foundation of democracy which sees reality as a gray spectrum without fully black or white limits. Local decisions are hedged, because, in most cases, they should be.

Connecticut has also given local communities the option of deciding wetlands permit cases, and all but 15 local municipalities have chosen local option. There are three questionable features of the Connecticut system however. First, appeals from local decisions are directly to the courts. Whether courts of law should decide technical matters requiring advanced knowledge and expertise is a question of legal philosophy. In cases where questions of law may be minimal, but where issues of wetlands value are at stake, a strong case could be made for consideration by at least two levels of administrative deliberation before resort to jurisprudence. Second, local option in Connecticut has not been chosen by several large communities with significant wetland problems (e.g., New Haven). Third, once local option procedures are approved and adopted, the state looses subtantial control over a program it is expected to administer. No one except residents of particular communities knows whether local wetland permit programs are faring well or poorly in Connecticut. The "Connecticut program", in effect, is a coastal wetlands program with isolated consideration of fresh water wetlands in 15 communities. Beyond this, the territorial entity called the State of Connecticut contains 154 wetland regulation systems about which little is known except that they are run by municipalities which have satisfied the state's Department of Environmental Protection that they have met certain eligibility requirements.

In Rhode Island, local option takes the form of first refusal. If a town denies a permit, the state cannot approve it. Since local communities almost never issue unqualified denials (for reasons described above), this provision merely appears to give local communities home rule discretion without significant substance. Even New Hampshire's program, purportedly run entirely by the state, gives more substance to local opinion than this by at least formally requesting local opinion and thereby giving cities and towns the opportunity to use their political influence in the decision-making process.

Beyond local option, the Massachusetts system appears to fare less well than some other state programs. Both Rhode Island and Connecticut have separate coastal and inland programs, but the advantages gained from differential expertise required may be less important than the loss of uniform application of standards, policies and procedures. On the other hand, Massachusetts defines wetlands so broadly that permit decision-makers require general knowledge of water resources and cannot concentrate on vegetated wetland characteristics alone. Rhode Island's law appears better as an instrument for narrowing concern to vegetated wetland values, at least in its inland program. Connecticut and New Hampshire have defined coastal wetlands with tidal standards, while Massachusetts and Rhode Island have not. The elevations in the Connecticut and New Hampshire definitions provide what amounts to a buffer zone above most saltwater wetlands, while the Massachusetts and Rhode Island laws use distance rather than elevation as a criterion. Connecticut and Maine appear most rational in designation of exempt activities such as maintenance and emergency work. New Hampshire and Rhode Island exempt small (and even

not so small) wetlands as a technique for reducing permit load irrespective of differential values, and Massachusetts exempts agriculture and forestry in spite of evidence that these two types of activity severely impact wetlands. Connecticut and Maine have instituted formal coordination procedures with the Corps; Massachusetts, New Hampshire, and Rhode Island have not.

If local option to appeal to state decision-makers is a positive feature of the deliberative process, a state option to appeal to federal decision-makers is even more so. This is because the federal establishment can rule from a distance so remote from the location of controversy that it is capable of fully concentrating on the facts with minimum concern for local (or even regional) popularity. This is not to say that the federal establishment is unswayed by political influence; only that it is less so than the state or local agencies when matters of strictly local scope are at stake.

A parallel advantage of federal involvement is the reinforcement it provides state and local decision-makers. There is no question that the mere existence of "higher authority" reinforces determination to enforce laws at lower levels. Were the Corps of Engineers to do nothing at all, the mere existence of § 404 would be an effective deterrent to misuse of wetlands.

Finally, with its substantial resources, the federal establishment can provide funds which cannot or will not be made available by state and local governments: funds which may make the difference between a well-run and poorly-run wetlands management program.

Together with the opportunity to provide wetlands protection where it is inoperative or inadequate at lower levels of government and the existing coordinative potential between the Corps, EPA, and FWS especially (described earlier), the New England region has all of the elements necessary to move an existing adequate program into a category of excellence which could realize all of the potential benefits of the region's wetlands while guaranteeing protection of wetland values in perpetuity.

What appears to be needed is a fine honing of the existing system, not a radical change in objectives, funding, organization, or procedural mode. Most of the inadequacies of the present system could be eliminated by simple agreement on goals and more cooperative action rather than major change in present statutory authorities or responsibilities. With proper policy leadership, interagency antagonisms could be reduced, the New England states could exchange the best portions of each state's program, all states could follow the leads of Connecticut and Maine in seeking ways to better coordinate their programs with the Corps, and investigations of the region's wetlands programs such as has been attempted here could be conducted with standardized records, thus making possible periodic audits to improve responsiveness to program objectives.

Data in support of these summary findings and conclusions are elaborated in detail throughout Part II of this report.

3. Economic Factors Affecting Wetland Trends.

The evaluation of economic factors affecting wetland trends in New England began with the assumption that clear specification of these

trends would be available from this project's study of physical changes in wetlands. As indicated earlier in this summary, there were problems of comprehensiveness, specificity, and reliability in the data obtained on physical wetlands trends. To this extent any analysis of factors impacting trends suffers an "identity crisis": we suspect the relevance of certain independent variables but lack a fully reliable and specific set of dependent variables against which to test them.

Economic factors have been approached in several ways in Part III of this report. First, the data on wetlands changes in Massachusetts and Rhode Island over the most recent 20 to 30 year period were analyzed with regard to parameters such as reasons for change where known (provided in rough form in the physical change data), demographic variables, and type of economic activity. Second, an attempt was made to relate wetlands permits awarded to housing permits and value of construction contracts. Third, regression analysis was attempted using several relationships between wetland change and economic factors. Finally, an attempt was made to reverse the direction of analysis by looking at evidence for wetland impacts on the regional economy.

Some findings resulted which confirmed standard expectations about growth. For example, a correlation was found between population increase, road construction, and loss of wetlands. The County of Barnstable (Cape Cod) in Massachusetts is a good test case. This was the fastest growing county in the state from 1950 to 1970 and in the same approximate period it showed over one half of all coastal wetland losses in Massachusetts.

Most studies reveal highway construction as most significant in influencing wetland change (both positively and negatively), and this mirrors the growth of tourism and service industry in both Massachusetts and Rhode Island (pursuits which require intricate road networks). The relationship between large gains in open wetland and construction of impoundments may reflect changing recreational life-styles. The decline in agriculture appears to induce wetland gains through abandonment of former agricultural drainage systems. The author of Part III notes that "Regression analysis indicates that as population density increases, loss of shallow fresh water wetland increases at an exponential rate". However it is not possible to isolate the separate causative factors statistically. Analysis of wetland permits cannot be used to relate economic trends to wetland permitting trends because the wetland permit data are available for too brief a time period.

On the matter of the impact of wetlands use on the economy of the region, a recent study concludes that over 90% of Massachusetts' wetlands should be preserved if the choice is between net development value and the value of wetlands in their undisturbed state as measured by prices paid by willing buyers to willing sellers of wetland real estate.

Everyone at the wetland regulatory level is aware that there are, indeed, economic pressures to both develop and preserve wetlands. If persistent rumor could be interpreted as fact, one would have to believe that behind all of the idealistic rhetoric and political or legal maneuvering which attends wetland development controversies lie a series of actual concerns which relate to money and not *per se* to roads, houses, birds,

fish, wildlife, or even public health. A neighbor fears loss of value in his home which represents almost all of his capital assets. A developer sees an opportunity to make a profit. A landowner sees increased value in his land if he can make formerly wet land dry and buildable. A poorly planned highway's location cannot be changed because planning contracts have already been paid.

Such stories abound. But they can be neither verified nor disproved by the level of study undertaken for this regional assessment. They require survey research of a highly investigative nature which is well beyond the scope of this endeavor.

CONCLUSION AND RECOMMENDATION

This project has been conducted under an assumption that the critical task was to focus attention on the institutional means employed by the New England region to manage the use of the region's wetlands, as described in detail by OTA's "Statement of Work" for Tasks 2 and 3. In conformance with this assumption, project personnel have gone to considerable length to describe in detail the interplay of federal, state, and local wetlands control programs; the laws, regulations, and court cases which impact these programs; the amount of program activity including processes and manner of operations; and the criteria or bases upon which decisions have been made.

It may be deduced that the philosophic underpinnings of wetlands protection are assumed desiderata, or at least that OTA is interested in program description, not in extent to which side-taking on broad economic and environmental issues impact the way in which those programs are

administered. However, degree of controversiality is a vital component of program effectiveness, and to that extent is a vital factual component of any assessment of program. Is the public becoming more save-the-sinking-economic-ship oriented, less dispassionate, less worldly? Does immediate cash flow crisis reduce visionary predisposition? Is environmental concern becoming a tired philosophical orientation--less de rigeur? Is wetlands protection becoming an accepted standard in the sense of sacrificing freedom to use property for the sake of stewardship for mankind (as appears to have happened in the case of zoning regulation)?

Wetlands are still considered wastelands by some. Imaginative use of "useless" land is still often considered a progressive action to be encouraged notwithstanding the fact that "useless" may be defined in short-range, human, and usually immediate economic benefit terms rather than in long-range, environmental benefit terms. This view usually proclaims that what is immediately good for man is paramount; what is long range for nature is too idealistic, uncertain, academic, and will impact future generations, not self. It is stated that we should put nature to work for man and let future generations worry about corrective action if present action is a long-range mistake.

The paradox of wetlands control is that these views are part of the controversy which attends relatively big projects with large economic stakes. Yet these are precisely the types of projects which receive maximum control attention in the present system, while "little" things, where the deep philosophical considerations never surface at all, may in fact have far greater cumulative consequences.

Perhaps the lesson to be learned from this paradox is that swings of the public-opinion pendulum are interesting, but less important than the fact that at least the issues are increasingly seeing the light of day. Our system of freedom of action depends on an assumption that knowledge will eventually save us as long as the biases expressed through emotional side-taking do not permanently impair the public willingness to accept fact at face value. We can tolerate strong, emotional, and compelling shifts in public opinion as long as they do not permanently impair public perception of reality or preclude the desire to seek out the truths of new knowledge. In spite of a recent shift in public focus on individual initiative to the relative exclusion of philosophical concern for the long-range fate of the environment (indeed, the world), wetland values have been increasingly recognized, and once recognized, are not likely to be foregone by established institutional mechanisms designed to protect those values. The question is how effective the institutions are, not whether public sentiment of the moment favors the protective charge given to those institutions.

The wetlands management programs described in this report, though imperfect in many respects, yield strong evidence of steadily increasing sophistication in the processes designed to consider wetland actions which should be permitted or denied (even for relatively "small" projects), and these processes have significantly raised the level of public awareness of both the short and long range issues involved. Efforts to reduce the scope of these programs should therefore be discouraged.

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PART I

PHYSICAL ASPECTS OF WETLAND CHANGE IN NEW ENGLAND

by

Kevin Richardson and William MacConnell

PHYSICAL ASPECTS OF WETLAND CHANGE IN NEW ENGLAND

Introduction, Quality of the Physical Record

The data sources used for wetlands change interpretation in this regional assessment were compiled from maps made from aerial photos. The process of wetland mapping by aerial photo interpretation is accomplished in the following steps:

1. Each wetland site is located on stereo vertical aerial photographs of varying scale (1:7,200 to 1:130,000) using magnifying lens or mirror stereoscopes (2x-20x).
2. Each wetland is characterized by a set of criteria or a classification system based on characteristics which may be identified on aerial photographs.
3. All wetland sites are measured for area by planimetry and tabulated by type by political or watershed unit.
4. Most interpretation projects transfer the classified information to USGS base maps using conventional cartographic transfer processes.

The precision of the aerial photographic interpretation is dependent upon photo scale, photo quality, season of the year, type of film, stereoscope used, skills of photointerpreters, and the inherent precision of transfer devices and planimeters. Wetland photointerpretation requires considerable skill, but even with skilled interpreters there will be differences over time with the same interpreter as well as differences between interpreters. Periodic field checking of difficult-to-identify sites allows for "calibration" of interpreters and improves classification

accuracy. Rigorous quality control involving review of the work by supervisors is necessary to insure high quality and reasonably uniform results.

There can be significant differences between classification systems applied by the same photo interpreters. It is important to caution all persons who attempt to compare physical wetland data records between different wetland studies, even those which used the same classification system, for different time periods. For example, if one compares results from a study which used USDI Fish and Wildlife Services Circular 39 for a classification scheme with a study which used the National Wetland Inventory Classification System, he will find no direct correspondence between wetland types in the two classification systems. Consequently, it is difficult or impossible to compare detailed results when different classifications have been used. Varying minimum sized typing units cause area statistics to vary substantially.

The studies used for the physical wetlands change record in this regional assessment generally appear to be accurate. All had high quality imagery, good interpreters, and considerable field checking of results. Swartout recently completed an accuracy assessment of the National Wetlands Inventory work within the New England region, and found it to be in the 95% to 98% accuracy range. John Organ's work was carefully ground checked. Maine's data, in part, was closely checked. Unpublished work done for the Massachusetts Coastal Zone Management Office by MacConnell's staff at the University of Massachusetts is considered "high quality", as is the work in Bristol County by Mueller and Cunningham.

However, apart from questions of accuracy, there are other data limitations which must be noted. One of the major shorcomings of all New

England studies except for Organ's study and the National Wetlands Inventory (both limited to the very recent period) is that they do not identify wooded wetlands. Most aerial photographs were obtained when leaves were on trees, obscuring surficial water from view. In the past, the scientific community did not demand information about wooded wetlands because little was known about their functional value or how to recognize them on airphotos. The time when appropriate aerial photographs can be taken with no cloud cover, no leaves on the trees, and no snow on the ground is relatively short in New England. Fall imagery is inferior to spring imagery because of a lack of surficial waters during that season. The added cost of difficult photo interpretation, poor accessibility, and the need for field checking for wooded wetland mapping were all major disincentives. There was also some doubt about wooded wetlands being covered by the various wetland laws. Yet, in heavily wooded New England, forested wetlands represent the highest proportion of all wetlands in terms of acreage (estimated at 60% by Organ, 40% by SCS). Thus, the type of wetland resource that we know least about may be the largest wetland resource. This is a major gap in our information base. It is especially provocative because forestry activities are most frequently exempted or placed in general permit status by regulators, thus inviting potential major alteration or loss without adequate monitoring.

Description of the Principal Data Record Used for the Assessment

Numerous wetland studies were reviewed to assess wetland mapping and wetland change in New England. Some studies are unpublished data obtained from the research investigators while other sources represent expert opinion based on incomplete data such as the National Wetland Inventory (NWI).

National Wetland Inventory maps are the most consistent source of regional and national information, but few tabular statistics are yet available. The NWI project has also been conducting a national wetland trend study and some preliminary results are being reviewed by the Fish and Wildlife Services. No results are yet published. OTA should maintain contact with Mr. Bill O. Wilen, director of the NWI project in Washington to obtain the results of this study of wetland dynamics and man's impact on wetlands.

Several important points should be mentioned as prerequisite to reading this brief review of the sources of physical data on wetland mapping, trends, and man's influences. First, for purposes of evaluating the effects of Sec. 404 of the CWA of 1972 on man's activities in regulated wetlands, no trend studies have been completed since the regulations have taken effect. There are no hard physical data on which to make judgments for the decade that the law has been in existence. Second, only three studies within the region included mapping and/or compilation of tabular statistics for forested or wooded wetlands. Therefore, we have little physical data on the present status of wooded wetlands, and only a very limited idea of man's influences on them.

USDI Fish and Wildlife Service National Wetlands Inventory (Figure 1)

This inventory is a source of uniform wetland maps for the region and the nation at 1:24,000 and 1:100,000 scales. Wetlands are interpreted on high altitude aerial photographs usually at 1:80,000 photo scale on panchromatic film. Field checking of sites is concentrated on areas which have been problematic for photointerpretation. Quality control occurs in both the regional and national NWI and accuracy of the products is uniformly

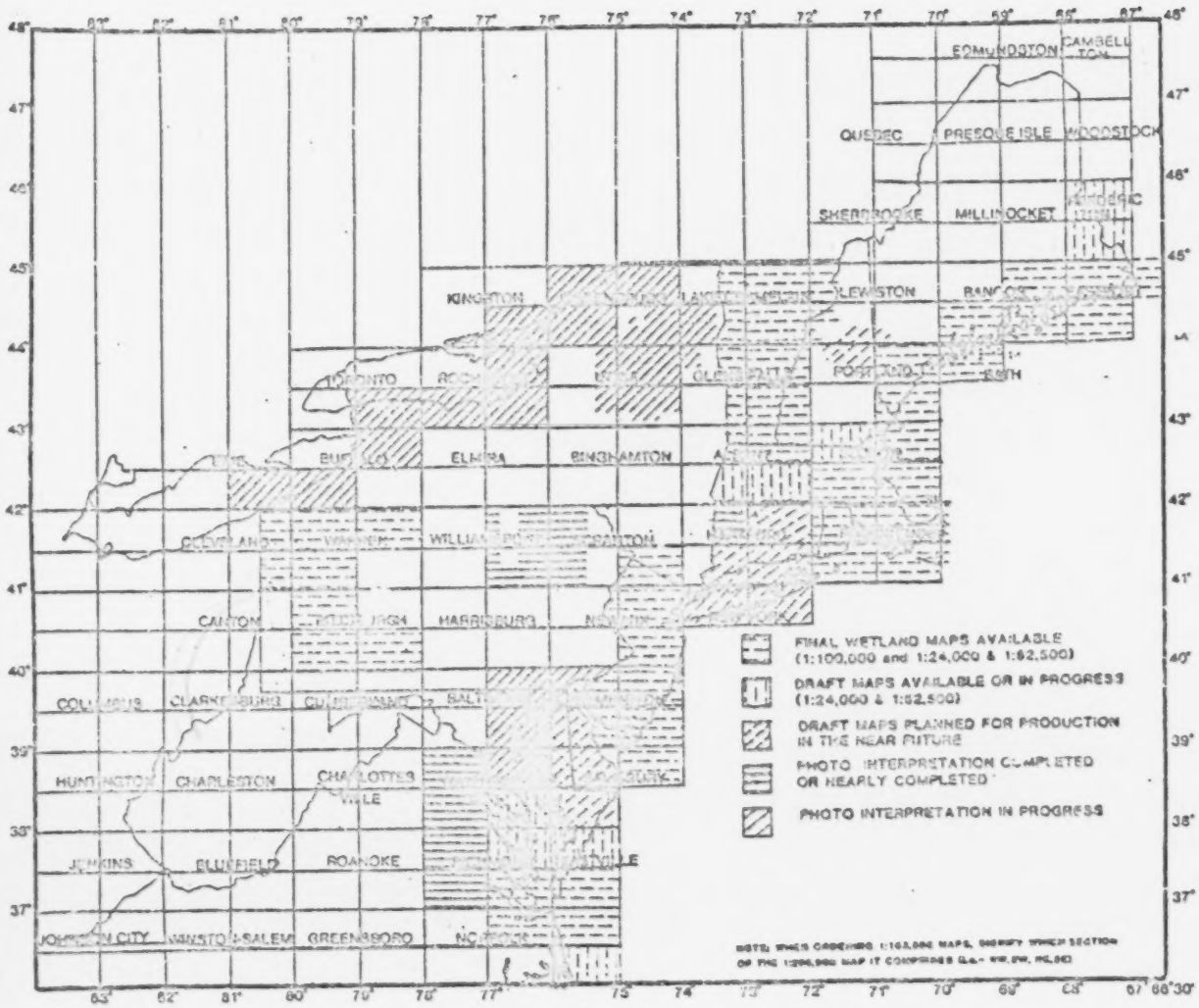

FIGURE 1

STATUS OF NATIONAL WETLANDS INVENTORY

United States Fish and Wildlife Service

Region 5

April 1, 1982

excellent. However, maps of this region have not been completed and few area statistics have been compiled for the region. No identification of man's influences on wetland trends or use has yet been made. Wetlands are mapped down to one acre in size where they are scarce and there is space to put the classification symbols on a 1:100,00 scale map manuscript.

The NWI national wetland trend study has sampled 3,600 study sites using 1950 and 1970 aerial photographs where available to determine wetland changes and the influences of man's activities on wetlands. Changes are classified as agricultural, urban or other. It is reliable statistically (95% confidence levels) on a national level, but confidence levels in the data drop considerably for smaller regions. Presently the data are in final stages of collection and results have not been analyzed or published. Preliminary estimates of the amount of forested wetlands in the region are in the range of 15-35% of total wetand area, but the estimates are based on incomplete data and a small number of samples within this region.

John Organ's 15 Massachusetts Towns - an intensive study of man's influences on wetlands from 1951 to 1977

This study used 15 towns, 5 coastal and 10 inland, in Massachusetts that had experienced high rates of growth between 1951 and 1977. The sample of towns, however, is biased because no large cities are represented, but it does represent the various physiographic regions within the state. Sample towns were selected where developmental pressure would possibly exhibit a higher incidence of wetland changes traceable to human activities. The work was done by an experienced NWI wetland photo interpreter using 1951 and 1975 or 1977 photography interpreted simultaneously to identify change. The product includes evaluation of man's influences on wetland trends and

includes wooded wetland data. The national wetland classification system was used and much field site checking of interpretation was done to assure a high degree of accuracy. The sample size is limited, but in many ways the study is the highest quality detailed data on wetland trends within the region.

The data are computerized and presently are undergoing analysis and interpretation of results. The schedule of analysis and interpretation was accelerated so that results could be used in this study. Additional data analysis has been completed in order to separate differences between coastal and interior wetlands. Data sets were compiled and analyzed, removing wetland types not regulated under Sec. 404 such as deep water habitats and non-vegetated wetlands. Special data runs were made to contrast the direct influences of human activities with those of "natural" origin such as succession and beaver activity.

MacConnell's Land Use/Change Study, Massachusetts 1951/71

A detailed vegetation and land use study with tabular data for 1951 and 1971 for the entire state of Massachusetts was done by MacConnell, but no wooded wetlands were mapped or tabulated. Wetlands were mapped but some changes in the classification system occurred. The author states, "The method of classifying wetlands was sufficiently different in the 1951/52 study and the 1971/72 study to make it unwise to compare areas to detect wetland changes". (MacConnell, "Remote Sensing: 20 years of Change in Massachusetts, 1951/52 - 1971/72", p.42.) Probably the only accurate method of detecting subtle wetland changes using airphotos is for one interpreter to view the sequential photographs of the same wetland simultaneously.

MacConnell's Connecticut River Recreational Land Cover/Use Study: 1952-1965 (for Massachusetts, New Hampshire, Vermont and Connecticut, 4 Vols.)

Land use and vegetative types, including wetlands, were photo-interpreted for a 1,000 foot strip on both sides of the Connecticut River on 1952 and 1965 airphotos for Massachusetts, New Hampshire, Vermont and Connecticut. Wooded wetlands were not identified or tabulated. Results of the study are probably biased because the study is concentrated on the Connecticut River floodplain and probably has a disporportionate representation of some wetland types. The data, as such, have limited utility for regional or state-level comparisons.

MacConnell's Coastal Zone Study, Massachusetts, 1951-1971

This is a photo-interpretive study along the Massachusetts coastline from near highwater mark to 1,000 feet inland and to the upland edge of all coastal wetlands. The study includes maps and land use change information about man's activities in the coastal region. The area data are unpublished in tabular/matrix form and are available from the author. They have not been statistically analyzed. The study is a valuable source of data for coastal zone Massachusetts although over 10 years old.

MacConnell's Remote Sensing Land Use and Vegetative Cover in Rhode Island-1970

Kupa and Whitman: Land-Cover Types of Rhode Island: An Ecological Study-1962

These were independent studies using the same classification system for Rhode Island in 1962 and 1970, both interpreted from aerial photographs with field checking of some sites. Significant differences in acreage totals for counties and state exist between the two reports and are unexplained. The reliability of the data for comparative purposes is,

therefore, questionable.

Larson et al: A Model of Natural and Man Induced Changes on Open Freshwater Wetlands in the Massachusetts Coastal Plain

Based on Mueller's thesis work cited below, this study shows agriculture, cranberry culture, and highway construction to have been the major forces of change in wetlands for that study area and period. However, woodland wetlands were not classified. Some wetlands such as shrub/scrub swamp can grow into wooded wetland and disappear as a wetland type. Consequently, there is an incomplete explanation of the dynamics of wetlands in this study.

USDA Soil Conservation Service: Water and Related Land Resources of the Connecticut River Region, Massachusetts

Portions of this comprehensive review of the natural resource data for the inland region of the Connecticut River watershed lands contain in-house reports on wetlands and projected changes in wetlands for the period 1977-1990. The data were in part extracted from MacConnell's data on Massachusetts land use and are subject to the same cautions. The SCS personnel grouped wetlands and estimated wooded wetlands areas based on USGS swamp symbols on topographic sheets and their own watershed studies. The projected wetlands loss figure of 5.6% from 1977 to 1990 is in step with the estimate of 5.0% inland wetlands losses for 1951 to 1975 in Organ's study.

Massachusetts Department of Environmental Management: Inland Wetlands Regulatory Program

Ten communities have been mapped on 1:4,800 scale Orthophoto maps using 1:7200 scale "leaves off" photos to identify the wetlands. No change data are tabulated nor are causal factors identified. The maps

are prepared to be accurate for court cases involving wetlands.

Maine Department of Inland Fisheries and Wildlife: Wetlands Inventory Data

The wetlands are classified according to USDI Circular 39 on aerial photos from the late 1960's and early 1970's. Many sites were visited and mapped in the field by field biologists. Wooded wetland data were included for those portions of the state that were mapped. Unpublished tabular data are computerized for most of the inventory data. Maps are available upon special request, but there are photo reproduction/scale problems similar to those encountered in SCS soil maps.

Maine Land Use Regulation Commission: Wetland Mapping Data

Wetlands 10 acres or larger are mapped on large scale maps that also contain other resource and zoning data. Wooded Wetlands are not mapped, nor are tabular statistics available. The Commission is responsible for land use regulations and zoning in the unincorporated northern one third of the state.

Mueller and Cunningham Studies. Master's Theses. Bristol County, Massachusetts: Coastal and Inland Wetland Studies of Change from 1951 to 1971

These studies are detailed photo-interpretive work with extensive field checking and with very good data for Bristol County. The data include information on changes in wetland types due to man's activities but no wooded wetlands were typed or tabulated. Mueller's work is the basis of the work by Larson et al., that developed a model of wetland change and dynamics. Cunningham's work was reported in the Proceedings of the Northeastern USFW Service. Tabular information is available in the original bound theses.

TABLE P1. SALIENT PHYSICAL DATA SOURCES, NEW ENGLAND REGION

DATA SOURCE	PUBLISHED	REGION-WIDE (INTERSTATE)	STATE COVERAGE	MAPPED	TABULAR DATA	TREND DATA	MAN'S INFLUENCES	DATA SINCE 404	NOTES
Nat'l Wetlands Inventory	Y	Y	I	I	N	I	I	N	In Progress. Little tab.
Mass. Coastal (MacConnell)	N	N	Y	Y	Y	Y	Y	N	1,000' inland, high tide
Mass. Coastal (Cunningham)	Y	N	N	Y	Y	I	Y	N	No data on wooded.
15 Mass. Towns (Organ)	N	N	I	Y	Y	Y	Y	N	Wooded included.
Bristol County (Mueller)	Y	N	N	Y	Y	I	Y	N	No data on wooded.
Bristol Ct'y (Larson et al)	Y	N	N	Y	Y	I	Y	N	No data on wooded.
R.I. Cover (Kupa et al)	Y	N	Y	Y	Y	N	Y	N	1962 photos. No wooded.
R.I. Land Use (MacConnell)	Y	N	Y	Y	Y	Y	Y	N	No data on wooded.
Accuracy Ass't (Swarthout)	N	N	I	Y	Y	N	N	N	Verified data: NWI;State
Mass. Inland Mapping & Reg	Y	N	I	Y	Y	N	N	N	Limited data so far.
Coastal Dredge (BSFW)	Y	Y	Y	N	Y	Y	I	N	Limited to dredge & fill
Ct. River Region (SCS)	Y	N	I	N	I	I	I	N	Some wooded; loss proj'n
Ct. River (MacConnell)	Y	Y	Y	Y	Y	Y	Y	N	1,000' both sides of R.
Champlain (MacConnell)	N	N	I	Y	Y	N	I	N	FWS contract work
Champlain (EPA)	N	N	I	N	Y	N	N	N	Corps Juris. Study
Maine Inland (DIF&W)	Y	N	I	Y	I	N	N	N	Dated.
Maine Wetlands (LURC)	Y	N	I	Y	N	N	I	N	Over 10A mapped. No wood

KEY: Y=Yes; N=No or Not Available; I=Incomplete

The following table summarizes the sources and characteristics of this physical wetland data record for the New England states. (Table P1)

General Findings

The literature on wetland change and its causes is confusing because interest in it is new and methodology is not yet sorted out. Man's direct intervention in the way of agricultural drainage, chanelization, dredging and filling, and construction are easy to identify on aerial photographs. Direct intervention by beavers is also easy to identify. Most of the other changes have been called "natural" or successional but many researchers now suggest that many or most of these changes are affected by man's activites, so it may be wise to identify direct intervention by man or beavers and leave all other causes of change in the "unknown" cause category.

Much wetland change is from one wetland category to another - a scrub/shrub wetland may grow up to become a wooded wetland, or after prolonged high water the trees in a wooded wetland die and it becomes a dead wooded wetland. Much change occurs between deep marsh and open water depending upon floating vegetation or the lack of it. Such open water is usually listed as a wetland, so a brook can be dammed to inundate a wetland and the activity would not reduce the total amount of wetland, but the use, value and aesthetic quality would be radically changed. It would help if fresh open water were no longer considered to be a wetland.

"Wetland loss" or "wetland gain" should be distinguished from "wetland change". "Wetland loss" should be wetland going to upland or to fresh open water. "Wetland change" should be a change from one wetland class to another. Both "wetland loss" and "wetland change" are hard to identify

because it is usually a continuum out there and the types gradually grade one into another with no distinct boundary between wetlands or between wetland and upland or between wetlands and open water. For these reasons it is hazardous to generalize based on total figures. To detect wetland change the photointerpreter should view the sequential imagery at the same time and record the "from" type and what it has changed "to".

The New England states have been extensively glaciated and, as a result, support a wide variety of wetland ecosystems. Recent work shows that these systems are inherently dynamic and strongly influenced by man's intervention (Larson). As man's direct activities impact and confound the natural processes, an acceleration in wetland types as well as losses or gains in total amount of wetlands often takes place. Man's indirect effects such as sedimentation, road salting, increases of roof top and black top, increases in uses of chemical fertilizers and herbicides as well as increases in acid rain also contribute to significant changes in wetland ecosystems. Wetland types change and wetlands are lost or new wetlands are created.

As a general rule, over the last fifty years the land use of the northeast region has reflected major agricultural abandonment, reforestation, urbanization and residential growth, and major construction of highway networks. Increasing population and a fixed land base have accelerated the pressures of development and expansion of man's activities.

The best available sources show that in the past coastal wetlands have been abused and filled for development with many acres lost, but that trend has slowed considerably. The major man induced causal factors for wetlands change in rapidly developing coastal areas are highway construction, resi-

dential housing, industrial/commerical development, and major shifts in agricultural uses, most caused by farm abandonment. Housing and commercial development cause losses, highways usually cause net losses by invading wetlands but the drainage pattern is changed and some new wetland and open water are created. Most farm abandonment creates new wetlands as drainage facilities are not kept up. Cranberry management changes the character of wetlands.

The inland areas of the southern New England states of Connecticut, Rhode Island and Massachusetts appear to have similar causes of wetland changes with the largest single cause of vegetated wetland losses appearing to be the development of impoundment (Organ). The Organ study describes a 12.7% increase in wetlands lost to impoundments in the form of small pond construction in existing wetlands for the purposes of farming, recreation, or fire control.

The inland areas of New Hampshire, Maine and Vermont represent the majority of land area in New England. The principal land cover is forest with timber harvesting and agriculture the major industries. Local sources confirm (personal conversations) that timber harvesting and agricultural activities are major causal factors of wetland change. Wood is no longer moved by river drive in Maine, so construction of high quality roads, some of them to accommodate trucks with 12 foot bunks which haul over 30 cords of wood per load, are rapidly being built by private landowners. Most wetland change in timber harvesting is caused by road building and erosion caused by log skidding. In the more rapidly developing areas of southern Vermont, southern and central New Hampshire and south central Maine, causal factors similar to those in southern New England, such as highway construc-

tion, residential housing, and agricultural reclamation and abandonment affect wetlands.

Organ's study of 10 inland and 5 coastal towns revealed a net loss of 436 wetland acres between 1951 and 1975/77, about 1.2% of the 1951 total wetland area. There was a gain in open water, and if the open category is eliminated as it should be, the net loss increases to 1,318 acres or 4.4%. If "natural or unknown causes" are eliminated 5 coastal towns show a net loss of 437 acres and ten inland towns show a 406 acre loss.

Organ's data also permit a breakdown by type of cause. Considering all 15 towns, 456 acres of open wetland were gained from impoundment, 185 were lost due to residential activity, 244 were lost from commercial and industrial incursion, 262 were lost to roads and airport access, and 76 were lost from unidentifiable actions.

The following four tables give percentage breakdowns for wetland change by type of factor causing changes in Organ's 15 town sample.

All sources of data confirm that the greatest change in wetlands in New England results from successional process. It accounts for about 2/3's of all wetland type changes. In the more forested areas beaver activity is often a major cause of wetland creation. Organ and others confirmed that beaver impoundment-abandonment is a major force for wetland change throughout inland Massachusetts, New Hampshire, Vermont and Maine. Beaver populations have increased rapidly and this trend can be expected to continue or accelerate unless increased harvest by trapping becomes more important than it is now.

The normal focus of the regulatory process is to prevent loss in wetlands, but exceptions are usually made for agriculture and forestry

TABLE P2.
Wetland Changes 1951-1975/77
15 Massachusetts Towns*

Causes of Change	Percent Distribution by Type of Wetland: All Types	Man-Induced	Man-Induced less Open
"Natural"			
Succession	63.8	----	----
Beaver	5.3	----	----
Man-Induced			
Impoundment	10.4	33.6	32.4
Highway Const.	4.3	14.0	14.2
Indust/Com Dev.	3.4	10.9	11.2
Residential	2.6	8.5	8.6
Agriculture	3.0	9.4	9.7
Agricultural Abandonment	2.8	9.0	9.2
Excavation	1.5	6.8	6.7
Fill	1.6	3.6	3.7
Miscellaneous	1.3	4.2	4.3
TOTAL	100.0	100.0	100.0

*Extracted from original data compiled by John Organ for the towns of Amherst Barnstable, Braintree, Concord, Florida, Newburyport, Petersham, Sandwich, Sheffield, Southampton, Topsfield, Westport, Weymouth, Whately, and Wilbraham.

TABLE P3
Wetland Changes 1951-1975/77
10 Massachusetts Inland Towns*

Causes of Change	Percent Distribution by Type of Wetland: All Types	Man-Induced	Man-Induced less Open
"Natural"			
Succession	66.7	----	----
Beaver	7.0	----	----
Man-Induced			
Impoundment	12.7	48.2	46.9
Indust/Com Dev	3.3	12.4	12.8
Excavation	1.4	8.1	8.3
Agriculture	2.0	7.7	8.0
Highway Const.	2.6	7.1	7.1
Residential	1.6	5.9	6.1
Fill	1.2	4.5	4.7
Agricultural Abandonment	0.7	2.7	2.8
Miscellaneous	0.8	3.4	3.3
TOTAL	100.0	100.0	100.0

*Extracted from original data compiled by John Organ for the towns of Amherst, Braintree, Concord, Florida, Petersham, Sheffield, Southampton, Topsfield, Whately, and Wilbraham

TABLE P4
Wetland Changes 1951-1975/77
5 Massachusetts Coastal Towns*

Causes of Change	Percent Distribution by Type of Wetland: All Types	Man-Induced	Man-Induced less Open
"Natural"			
Succession	54.7	----	----
Beaver	0.0	----	----
Man-Induced			
Highway Const.	9.9	21.8	21.8
Agricultural Aband.	9.4	20.8	20.8
Residential	5.9	13.0	13.0
Agriculture	5.6	12.3	12.3
Indust/Com. Dev.	3.7	8.2	8.2
Impoundment	3.0	6.6	6.6
Fill	3.6	6.3	6.3
Excavation	2.5	5.5	5.5
Schools	1.1	2.3	2.3
Ditching (nonagr.)	0.4	0.8	0.8
Miscellaneous	0.2	2.4	2.4
TOTAL	100.0	100.0	100.0

*Extracted from original data compiled by John Organ for the towns of Barnstable, Newburyport, Sandwich, Westport, and Weymouth.

TABLE P5
Net Wetland Losses 1951-1975/77
15 Massachusetts Towns

Wetland Category or Process	10 Inland Towns	5 Coastal Towns	Total (15 Towns)
Open Wetland Losses	(Gain)	(Gain)	(Gain)
Losses by "Natural" Processes	(Gain)	(Loss not Spec)	(Gain)
Losses for All Types	0.3%	2.0%	1.2%
Losses for All, Less Open	5.0%	3.9%	4.4%
Losses for All, Less "Natural" and Open Combined (i.e., Man-Induced and Vegetated)	6.5%	3.1%	4.6%

or changing wetlands to open water. There has been no apparent effort to evaluate the impacts of wetland losses in the region caused by these activities. Some of the data indicate there may be a major problem associated with agriculture-related pond construction on existing wetland sites.

Projection

In a joint study by USDA Soil Conservation Service and US Forest Service in cooperation with the Massachusetts Water Resources Commission, inland wetland losses were projected to be 5.6% for the period 1977-1990 in the Connecticut River region of Massachusetts. The assumed cause is listed as development and represents approximately 4,000 acres in the 85 town study area. The study was based on a sample of 85 towns in the Massachusetts portion of the Connecticut River valley, accounting for past development, present permitting activity levels, and population growth. The above projection is consistent with Organ's data for inland wetland loss for the period 1951-1975/77 of approximately 5%.

Recommendations

1) Encourage adoption of the National Wetland Inventory Classifications System as a national standard.

2) Ensure that this program is continued to complete the baseline inventory and incorporate periodic change analysis to enable future assessment of wetland trends.

3) Mandate the encoding the NWI data on computer tapes so that periodic update and tabular data summaries can be facilitated.

4) There is sufficient reason to believe, based on the data reviewed, that general permit activities or exemptions such as agriculture and

forestry need further study by detailed change detection to see if these activities are causes of wetland losses. Concurrent review of SCS pond building work for the study areas and for the study period should attempt to identify any correlation between wetland losses due to impoundment and pond construction activity by SCS or other agency fundings such as ASCS.

Significance of Wetland Succession (footnote by J. S. Larson)

Available data indicate that a great deal of change in dominant wetland vegetation is successional and that a large acreage of open wetland, given time, will become forested wetland. Researchers have termed this natural succession, rather than man-induced. However, it can be argued that if the open character of a wetland is due to cutting, farming or grazing prior to 1850, then the return to forest should be regarded as man-induced. The argument itself is not important as long as the process is understood.

The effects of re-forestation are in the realm of speculation. Clearly, if the function of a wetland changes significantly with change in dominant vegetation, the dynamics of change may need to be considered in the regulatory process. The effect on wild animal species and on shade intolerant plants is the least speculative. General effects on mammals and nesting birds can be inferred from the published literature and will not be treated here. The loss of open wetlands in otherwise forested landscapes will reduce visual diversity and contrast, resulting in a visual scene less pleasing to the human eye. While this shift in preference can be quantified, it is not likely to be a prime influence on public policy today.

The effect on hydrology is of much higher interest, but more speculative. Generally speaking, an herbaceous ground cover is more likely to yield more run-off than a forest. At the New England latitude trees extract water and generally have a net negative impact on local groundwater and run-off. This suggests that there may be reductions in stream flow and discharge peaks as wetlands become forested. Increased roughness due to tree trunks and woody shrubs may reduce velocity, sediment transport, prolong discharge, and reduce flood crests to some degree.

Increased shading may reduce water temperatures and prevent higher levels of dissolved oxygen. Energy formerly captured by frost-sensitive plants and seasonally released as nutrients from decaying plant material is likely to be retained much longer in woody stems. This could result in lowered levels of nitrogen and phosphorous in waters flowing through wetlands.

Studies to put quantitative boundaries on those possible effects of re-forestation hydrology are not well developed in the Northeast. Quantitative effects are not sufficiently well established to guide regulators.

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PART II

LEGAL AND INSTITUTIONAL ASPECTS
OF WETLAND PROTECTION PROGRAMS IN NEW ENGLAND

by

Alexandra D. Dawson and Pamela Harvey

MASSACHUSETTS

Wetlands Laws

With the passage of the "Jones Act" in 1963, Massachusetts became the first state in the nation with a state-level law protecting wetlands. The statute required a state-level permit for filling, dredging, or removing coastal wetlands. In 1965 a similar law was passed to protect inland wetlands. (Although over 20 states now have laws protecting coastal wetlands, only six have legislation specifically protecting freshwater wetlands.) In 1972, the two laws were combined in General Laws Ch. 131, s. 40 to form the Wetlands Protection Act (WPA), and initial jurisdiction was shifted to the conservation commissions, local volunteer bodies formed under G.L. Ch. 40, s. 8C, which had previously only had advisory authority. For applicants, abutters, etc. aggrieved by the local decision, the law allows as of right, an appeal to the state Department of Environmental Quality Engineering (DEQE), which considers the matter de novo and issues a superseding Order of Conditions. (This term is used for any permit issued under the WPA, even a denial.) If the superseding Order is objectionable to a party, an adjudicatory hearing under the state Administrative Procedures Act will be held under a DEQE hearing officer. The next level of appeal is to the state trial court, then the appeals court, and finally the Supreme Judicial Court.

Over almost 20 years, the WPA has grown organically into a complex law, still generally untested in the courts. Similarly, the extensive DEQE Regulations (last amended in 1978) have received little court interpretation in spite of approximately 300 appeals to DEQE per year for a superseding order of conditions and a few APA hearings. The WPA defines wetlands in terms of vegetation, but also

covers banks, beaches, dunes, land under surface waters, and areas subject to flooding (it is in fact a state floodplain protection law), as well as a 100-foot jurisdictional area around the wetlands, etc., added by state Regulation and often treated as a buffer. Whether areas beyond the 100-foot buffer are also covered is still disputed, since the 1972 law covers activities which "alter" wetlands; and alteration may occur because of distant activities. DEQE interpretation is generally that actual damage must be shown if the activity is outside the buffer area. This extensive jurisdiction, and the absence of any minimum thresholds such as those in the Rhode Island inland wetlands law, has rendered the WPA the best known and most active environmental law in the commonwealth.

Neither the wetlands act nor Regulations adopted under it deal directly with the issue of jurisdiction beyond the 100-foot area. Rod Gaskell of DEQE wetlands division reports several "preconstruction review" situations where a conservation commission tried to get jurisdiction over outside activities on the grounds of probable (not actual) damage--one from septic systems, another from sand and gravel mining. In each case, they failed to convince DEQE of probability of harm. Courts would probably feel the same--a very strong proof of probable harm would have to be offered. Mr. Gaskell knows of no case of actual harm proved; if it were, a court could order the usual relief: money damages, injunction against continued harm, and/or restoration of the area.

The law allows for an advance "determination of applicability," which is not to be confused with the determination process which weeds out "insignificant" projects in Rhode Island, Connecticut or New Hampshire; its sole purpose is to determine whether the law technically applies to an area or an activity. A negative Determination may be appealed to the

The usual use of the determination of applicability process is to establish the boundaries of jurisdiction; however, since the landowner cannot directly appeal a determination that the law applies, it is sometimes used to establish jurisdiction over areas/activities outside the 100-foot buffer.

A negative determination (that the wetlands act does not apply to an area or activity) may be appealed to DEQE by the same persons who may appeal a local Order (applicant, abutter, 10 residents, etc.) under Regulation 310 CMR 10.03(6). A positive determination, however, cannot be appealed until the landowner goes through a filing with the local conservation commission and gets a final Order 310 CMR 10.03(5). Development interests attempted to make both determinations appealable in the proposed new DEQE regulations. Ironically, the provision for determination was added to the law by development interests in order to insure a "certification" of how the law applies, which would make raw land more salable. They neglected, however, to limit <u>who</u> could ask for a determination, and the process is thus used by neighbors and conservation commissions as well as landowners.

The WPA protects seven wetlands values relating to flooding, water pollution, groundwater, water supply, fisheries and shellfish. Wildlife and recreation are not protected; thus the WPA does not qualify for takeover of the federal 404 program.

The WPA contains exemptions for mosquito control activities, emergency work, maintenance of some public utilities, and agricultural work in land already in some kind of agricultural use (this includes silviculture).

Time elements in the law are short: 42 days for a local decision,

70 days more for the state on appeal. When an adjudicatory hearing is required, however, several months will be involved. After work is properly completed, an applicant is entitled to a Certificate of Compliance.

A further regulatory filter to wetlands activities is provided by the Massachusetts Environmental Policy Act (MEPA), the commonwealth's "baby NEPA" requiring an Environmental Impact Report (EIR) for any major state-funded or state-permitted projects significantly affecting the natural environment. If the wetlands activity has been appealed to DEQE, proponents of most projects involving work on at least an acre of land covered by the WPA (including the buffer area) must submit an Environmental Notification Form (ENF) to the state Executive Office of Environmental Affairs, which decides whether an EIR must be prepared; where ten acres is involved, the EIR is mandatory. In addition, the MEPA review often catches projects which might affect or alter wetlands where the local Order of Conditions went unappealed--or was never sought.

At the same time that the WPA was taking shape, the commonwealth passed two other laws called the Coastal Wetlands Restriction Act and the Inland WRA. These substantially identical laws take a different tack: the state Department of Environmental Management (DEM) maps coastal or inland wetlands and records (in the Registry of Deeds where the land lies) a restriction which substantially limits use of the area to water-related uses such as docks, recreation, farming, and driveways into unrestricted land. The values to be considered in protecting wetlands under these laws are those under the WPA, plus wildlife. The landowner is given notice of the procedure and a hearing is held. After

the restriction is recorded, the landowner is given 90 days to bring an action in Superior Court if he believes the restriction constitutes a "taking"--overregulation without compensation. About 64 cases were filed by 1978; only one has been tried to conclusion. The restrictive laws have been most successful in coastal areas where over 40,000 of the estimated 60,000 acres of coastal wetlands have been subjected to the law. Only about 5,000 acres of inland wetlands have been restricted, mostly in the Charles and Neponset basins and on Cape Cod. The disparity probably reflects at least: wetlands boundaries harder to determine, more growth pressures in inland wetlands, and possibly a hardening of positions--the coastal wetlands were restricted very early on in the laws history. These two laws relating to wetlands make up the Coastal Zone Management (CZM) program.

Rod Gaskell reports that all or nearly all of the 64 appeals lodged with the attorney general on land affected by the restrictive wetlands laws relate to inland wetlands restrictions--in spite of the fact that over nine-tenths of the land affected is coastal! He believes that protection of coastal marshes is simply more acceptable because people live in the coastal area, work there is very visible, and the effects of poor land use in the coastal area have been disastrous. The restriction program has been slowed by personnel and money problems.

Adoption of local bylaws for floodplain regulation goes back to at least the early 1960s. Early attempts were either simply bylaws (Falmouth: no filling of coastal marsh without a permit from the selectmen) or followed the more sophisticated model suggested in a 1959 law review article by Allison Dunham of the University of Pennsylvania. Activity in passing local floodplain and wetlands bylaws or ordinances increased during the 1960s and 1970s and is still taking place as a result of several different trends, including the FEMA flood insurance program, requiring at least minimal land-use regulations in areas federally mapped as flood prone as a precondition to obtaining federally

subsidized flood insurance. The FIA 1978 report named 201 participating Massachusetts municipalities, but some of the bylaws are minimally protective and, on the other hand, a few communities not in the flood insurance program have some form of floodplain regulation. Many bylaws and ordinances go far beyond the requirements of FEMA; some prevent practically any development of floodprone areas (which must be shown on maps if the bylaw or ordinance is passed as part of the zoning codes) for anything but agriculture, recreation and boating uses. Some of these enactments cover wetlands as well as floodplains; and in any case many floodplain areas will be wetlands as well, especially in glaciated 'bathtub' rivers so common in New England.

Although most of these bylaws were enacted as part of the local zoning code, it has become recently more popular to adopt a nonzoning protective ordinance or bylaw because of such elements as: no need for maps; majority rather than two thirds vote; authority may be given to local conservation commissions.

Additional reasons for adopting local controls are: a desire to cover areas or activities exempt under the state WPA, to include values such as wildlife and recreation which the state law does not cover, and in some cases to thwart what was locally seen as the tendency of the state DEQE to modify or overturn the local conservation commission decision under the WPA.

The use of local zoning controls or local nonzoning bylaws to protect wetlands and floodplains was upheld by the state's highest court. Many more cases have been decided in Massachusetts under the local bylaws than under the WPA. These are principally important as showing the Massachusetts court's views on the constitutional "taking" issue: the degree of regulation which can be imposed without compensation.

Wetlands Cases

The first case to be tried under the WPA was Commissioner of DNR (now DEQE) v. S. Volpe (349 Mass. 104, 1965). The constitutional issue was directly raised in this first case, which concerned an application to fill a 50-acre coastal wetland for housing. The DNR produced extensive evidence of the ecological importance of the marsh, but the Supreme Judicial Court remanded to determine if the landowner had been deprived of substantially all the (remunerative) use of his land, which it indicated would be an unconstitutional "taking" without compensation. On remand, the findings of the master assigned to the case were so damaging to the state that it did not appeal the trial court decision in favor of the company. Hence the case was of limited precedential value.

Another salt marsh case tried three times during the 1960s under a local wetlands bylaw came to a substantially similar conclusion: a landowner who wished to place houses on seven acres of coastal marsh which a local bylaw had limited to recreational use was held to have been unconstitutionally deprived of the value of his land, and the local decision was overturned. MacGibbon v. Board of Appeals Duxbury (340 NE 2d 487, 1975) was a curious case in several respects: first, the local regulatory body was not allowed to discuss the hazards or difficulties of building houses or septic systems in the marsh because the local bylaw only forbade "fill" without a permit; second, the Supreme Judicial Court asserted that it had not decided any constitutional issue whatsoever, in spite of the "taking issue" language in the case, and claimed to be interpreting only the state Zoning Enabling Act which has been entirely rewritten since the decision (although not in any way clearly

affecting the result). The decision is thus also of limited precedential value, and was merely cited in a footnote, without other mention, in a more recent coastal wetland bylaw case, Lovequist v. Conservation Commission of Town of Dennis, 1979 Mass. Adv. Sh. 2210.

In the Lovequist case, the Supreme Judicial Court upheld the local Conservation Commission decision to deny an application to fill a coastal wetland to give access to a coastal marsh island, on grounds that the fill might "pull the plug" on local groundwater. The decision was notable because more money loss was involved than in the MacGibbon case, yet the Supreme Judicial Court upheld against the "taking" argument on the grounds that an existing roadway allowed for a single dwelling to be built on the upland area.

It is apparent that one of the major criteria used by the Massachusetts courts in meeting the "taking" issue is, whether the landowner has any residual remunerative use of the regulated land. The other major criterion is, the degree of public hazard involved in the proposed project. Turnpike Realty Co. v. Town of Dedham, the leading case on floodplain regulation was decided in 1972 (363 Mass. 221). It related to local floodplain protection bylaws which reduced the use of the Charles River floodplain in Dedham to agricultural and recreational uses--not very valuable in an urban area compared with the previous zoning which would have permitted apartment buildings. The realty company claimed a loss of 90 percent of the value of the site. The decision does not make it clear whether the court disagreed with these figures (other evidence was adduced to the effect that the area would have been too expensive ever to develop); but in any case the Supreme Judicial Court opined that

the regulation was merited by the extreme flood hazard inherent in developing an area sometimes under four feet of water. The bylaw had referred to three kinds of hazard: hazard to dwellers on the floodplain, to up and downstream landowners from increased flooding, and to the public generally from increased cost of public flood-control projects.

This major floodplain case was followed by three decisions of the court of appeals decided since 1972: Subaru of NE v. Board of Appeals of Canton (395 NE 2d 880, 1979); Turner v. Walpole (80 Mass. App. Ct. Adv. Sh. 1745), where a probably minute rise from filling a small part of a large floodplain was nevertheless held an adequate reason for denial, although the court did not specifically approve of the "incrementalist" approach; and S. Kemble Realty Trust v. Concord (80 Mass. App. Ct. Adv. Sh. 637) notable for the fact that the permitted uses o the floodplain area were very scant and little if any remunerative use was left to the landowners.

It thus appears that the constitutional taking issue in Massachusetts may be defined as follows: the courts will uphold reasonable regulation of environmentally sensitive areas if there is a demonstrable hazard in projects proposed for developing the area, especially if the landowner is not deprived of all of the development value of the land.

Three WPA cases after S. Volpe were all decided on issues relating to the statutary interpretation. Rutland v. Fife (81 Mass. App. Ct. Sh. 308) interpreted the difficult and circularly written regulation relating to the 100-foot wetland "buffer" to mean that the "bank" of the surface water around the surface could extend back for 100 feet. And the decision in Hamilton v. Conservation Commision of Orleans (81 Mass. App. Ct.

Adv. Sh. 1521) permitted a suit on the "taking" issue under the WPA to be brought under the eminent domain statute--a hint that the court might be willing to listen to the minority opinion of the recent U.S. Supreme Court decision regarding inverse condemnation: that landowners who suffered an overregulatory "taking" should be compensated. The Hamilton case was, however, dismissed for failure to select the right defendant.

Only one out of the many cases filed under the coastal and inland wetlands restriction laws has been decided by Massachusetts higher courts. In Moskow v. Department of Environmental Management (81 Mass. Adv. Sh. 2134), the landowner claimed an unconstitutional diminution of value because four out of seven of his acres in urban Newton along the Charles River were restricted, diminishing the number of houses he could build by half. The court, however, following the rule expressed above, decided that a mere diminution in land use was not a taking since he could still build some houses. Moreover, the court expressly approved the third kind of "public hazard" expressed in the Turnpike case, stating that the landowner would receive some benefit from the restriction in the form of protection against higher taxes from public flood control works which might be needed if the law were not allowed to stand.

Conclusions on Massachusetts Laws and Cases

It is notable that the Massachusetts courts have recognized principally the public hazard of flooding; loss or pollution of groundwater was first recognized in the Dennis case. The judge in MacGibbon refused to find possible losses to the ocean food chain from filling coastal

marshes a public hazard, probably because of the minor effect of filling 7 acres. He was also convinced by evidence in the case that coastal flooding and erosion dangers could be met by simple mechanical means such as hay bales. Acceptance of pollution attenuation evidence in the Moskow case shows a more sophisticated judicial attitude. Investigators are increasingly studying the value of wetlands as natural filters for certain chemical/organic pollution. The loss of this free treatment could then be adduced to demonstrate a "public hazard" in the cost sense, since the function would have to be replaced by expensive public treatment plants. Similarly, relationship of wetlands to groundwater drinking water aquifers is being refined throughout the state by USGS and privately funded studies, by hazardous wastes incidents and studies (Woburn) and by the work of the Economic Development Commission on Cape Cod, where all groundwater is found in interconnected aquifers. Until these matters are rendered into persuasive evidence, most permit modifications and denials, and most judicial decisions, will be based principally upon the flooding issue and will suffer from the incremental problem: it is hard to convince a judge that a little filling is a dangerous thing. Under these circumstances, much depends upon individual judges' feelings (sometimes the more conservative judges are the most inclined to honor "administrative discretion").

Another difficulty inherent in the WPA is the absence of protection of wildlife as a purpose of the law. In fact, all of the seven values which the law does protect are stated in terms of human values, not wetlands values; thus the law really protects people (their drinking water, flooding problems, fisheries, industry) rather than wetlands.

This is, in the eyes of local conservation commissions mostly a distinction without a difference. However, it is clear that the Army Corps, in following the recommendations of the United States Fish & Wildlife Service, may openly deny a project because of the value of wetlands for wildlife. This decision would still be subject to the "taking" argument, of course; and there is no current federal case stating whether such denial solely for wildlife reasons would be held confiscatory as to the landowner, absent any other public hazard of the more traditional nature. That the Corps may consider loss of the ocean food chain to be a public hazard was amply proved by the Zabel v. Tabb decision, where the judge announced that the ocean fish were definitely in interstate commerce (he may have meant tourist fish as well as edible fish).

The WPA exemptions for mosquito control, emergency work, and utility maintenance do not seem to have caused much trouble. The broad exemption for improvement of land for agricultural use led to the filling of a large cedar swamp in the early 1970s; the exemption was narrowed to apply only to work on land already devoted to agriculture and is not now a large problem. The state WPA exemption for agriculture is mirrored in an agriculture exemption under municipal zoning for farms over 5 acres and the 404 exemption for normal agricultural practices.

The hardest case for the courts to deal with, under Massachusetts law or under 404 nationwide permit standards, is the case of extensive filling of a wetland at a headwater area where compensatory storage may be assumed to take care of the flooding issue, where design standards cannot be arranged to work around the wetland and where the landowner has invested considerable money and has no upland which could be used

instead. This is particularly grave where only the WPA applies, since purchase of land subject to a recorded restriction under the two restrictive laws would presumably stop any but the original owner from complaint. A case of this nature, now in the process of being decided in the Southeastern town of Attleboro, is discussed below, under the Institutional Section.

Institutional

Introduction

Massachusetts has extensive coastal and inland wetlands. Its coastline, over 500 miles long, contains an estimated 60,000 acres of saltwater wetlands, according to the state Department of Environmental Management. The acreage of freshwater wetlands has been the subject of widely varying estimates (see physical data sections of this report). The MacConnell report estimated there were 320,000 acres of freshwater wetlands in 1971, not including forested wetlands. The percentage of state wetlands which are forested has been estimated at 30 percent (SCS), 20-45 percent (USFWS) and 60 percent (Organ study). The Organ study is limited to 15 towns, but the information is the most detailed. If he is right, there could be as much as 700,000 acres of inland wetland in the state. However, DEQE states that the SCS, using soils analysis, has figured that vegetated inland wetlands bordering on surface waters total only 352,975 acres--4.3 percent of the total land and water area of the state. Comparing a range of 350,000-700,000 acres plus the 60,000 coastal wetlands acres, with the SCS estimate of .4 percent annual loss in 1977-1990 (see physical data) would project a yearly loss of between 1600 and 4,000 acres of wetlands. This figure seems high and certainly does not

reflect the opinion of the state regulatory bodies.

1. Restrictive Orders

Under its coastal wetlands restriction law, the state Department of Environmental Management has recorded restrictive orders (permitting mosly recreational and water-dependent uses) on approximately 43,000 of its approximately 60,000 acres of vegetated coastal wetland. Only about 5,000 acres of inland wetlands have been so restricted. DEM reports few violations of orders and although many appeals have been filed, the recent Moskow case (see Legal Decisions) is likely to discourage their pursuit.

2. Wetlands Protection Act Activity

Although the law was first passed in 1963-65, no good data were available until the 1970s. It is clear that the total number of permits processed has steadily risen until the recent recession. Coastal and inland permits are not differentiated by the DEQE; but recent CZM reports indicate about a third of the permits are in the coastal region, including freshwater as well as saltmarsh. The coastal zone is defined to include all coastal wetlands and all areas extending back 100 feet inland from certain mapped roads (it includes all of Cape Cod, Martha's Vineyard and Nantucket).

WPA Permits Relating to Coastal Region

1979 CZM report - 1,115 notices of intent, 57 appeals

1980 CZM report - 817 notices of intent, 87 appeals

1981 CZM report - 1,006 notices of intent, 104 appeals

The statewide WPA filings (called Notices of Intent) rose from 1,276 in 1973 (including 2.5 months of 1972) to 2,747 in 1981 (down from 3,010 in FY1979) (see Tables 1 and 2). During that period, the number of appeals approximate 10 percent a year or less (3.6 percent in 1981). Of the 1981 appeals, 142 were by the applicant, 23 by DEQE and 69 by neighbors and other citizens (see Table 3). In one regional office in Western Massachusetts where more data was available, the appeal percentage was slightly higher (see attached Table 3a), with most appeals being brought by citizens.

It may be assumed that appeals by applicants indicate a "tough"--or realistic--local conservation commission, while appeals by abutters, etc. indicate a "soft" conservation commission--or obstructive neighbors--, though there are no real data to substantiate either view. DEQE appeals range from purely procedural defects to problems with "too soft" commissions.

DEQE does not break down these overall numbers; thus it is difficult to determine just how many of the above permits related to vegetated wetlands as opposed to floodplains, banks, waterbodies, beaches, dunes, and the 100 foot 'buffer' area (see Wetlands Laws). The western regional data for mid-1979 through mid-1981 (Table 3a) indicates that a small percent of the permit load relates strictly to wetlands (although of course other permit categories will involve some wetland acreage): the figures circle around 10 percent in 1980, 14 percent in 1981. These figures correspond roughly with the study of the files of three regions, discussed below, and the opinion of regional DEQE personnel. Thus the vegetated wetlands project load in Massachusetts is in the neighborhood

Table 1. Notices of Intent (Permit Applications) received by the Department of Environmental Quality Engineering under the Massachusetts Wetlands Protection Act of 1972.

Period Covered	No. of Notices	No. Appealed To DEQE*	Percent Appealed
10/72 - 12/73	1,276	137	10.7
1/74 - 12/74	1,362	81	5.9
1/75 - 12/75	1,422	150	10.5
1/76 - 12/76	1,845	179	9.7
1/77 - 6/77	NA	NA	-
7/77 - 6/78	2,953	286	9.7
7/78 - 6/79	3,010	239	7.9
7/79 - 12/80	NA	NA	-
1/81 - 12/81	2,747	235	8.6
TOTAL**	14,615	1,307	8.9

*Not clear from record that data for appeals are consistent. In some years, number may include catch-up from backlog in prior years. Also, in some years number may represent superseding orders issued, which appear to average about 85% of actual appeals.

**86 months.(7.17 years)

Table 2. Sample data showing activity level and disposition of wetlands permit cases handled by the four regional offices of the Massachusetts Department of Environmental Quality Engineering (FY 1978 - 1979).

Permit Action	FY 1978 Regional Office				FY 1979 Regional Office			
	S. E.	N. E.	Cent.	West	S. E.	N. E.	Cent.	West
Notices of Intent (permit applications)	1,235	1,054*	436	228	1,199	1,198	407	206
Appeals from local action	88	140	36	22	103	91	27	18
Percent appealed	7.1	NA	8.3	9.6	8.6	7.6	6.6	8.7
Superseding determinations (Intervention without appeal)	4	12	10	4	8	NA	8	4
Total acted upon	92	152	46	26	111	NA	35	22
Extensions issued	29	56	14	11	17	36	10	10
Percent extensions granted	31.5	36.8	30.4	42.3	15.3	NA	28.6	45.5
Superseding orders appealed	41	15**	2	1	29	26	5	4
Percent orders appealed	44.6	NA	4.3	23.1	26.1	NA	14.3	18.2
Certif. of Compliance issued	13	76	18	0	20	69	9	0
Percent compliance	14.1	50.0	39.1	0.0	18.0	NA***	25.7	0.0

* Included 60 "catch-up" from prior years.
** Estimated.
*** Probably well in excess of 50% (69 of 91+).

Table 3. Appeals to the state from local wetlands decisions by applicant and region - Massachusetts, 1981

Appellant	Region: Southeast	Northeast	Central	West	Total	%
Applicant	73	55	7	7	142	60.4
Citizens or Abutters	32	24	8	5	69	29.4
DEQE (Discretionary intervention)	15	5	1	3	24	10.2
Total	120	84	16	15	235	100.0

Table 3a. Detailed Data on Permits Initiated in the Western Regional Office of the Massachusetts Department of Environmental Quality Engineering, July 1979 to June 1981**.

Period Covered	Number Applic's	Number Veget'd	Number of Appeals by: Applic.	Abut'rs	DEQE	Supersed'g Orders	SS's MEPA*	Enforc't Actions
7-9/79	70	13	2	1	1	5	1	9
10-12/79	45	9	0	7	2	3	0	1
1-3/80	47	6	2	5	1	3	2	2
4-6/80	65	4	6	5	1	3	2	2
7-9/80	82	8	2	4	1	10	2	4
10-12/80	50	6	1	3	0	6	2	4
1-3/81	36	4	1	1	0	4	1	10
4-6/81	84	13	1	3	1	6	3	4
TOTAL	479*	63	15	29	7	40	13	36

Types of Projects	Total	Percent
Residential	118	25
Commercial/Indust.	79	16
Recreational	62	13
Road	79	16
Other	144	30
TOTAL	481*	100

*Superseding Orders subject to Massachusetts Environmental Policy Act review.
**Data compiled from the DEQE Western Region Quarterly Reports.
Discrepancy in the totals is part of the record and is unaccounted for.
- Only the second column in this table relates to vegetated wetlands.

of 300 permits a year, rather than 3,000. Gaskell believes (and our data would confirm) that activity in coastal areas relating to wetlands amounts to not more than 10 percent of permit applications--and probably less.

The coastal program gets a boost from the CZM program which provides dollars for state staffing for various purposes, including review of all WPA applications in the coastal zone (including all of Cape Cod, Massachusetts' fastest-growing area). CZM also regulates federal permit and funding activity to some degree through the "federal consistency" certification. CZM money has been responsible for mapping critical coastal areas for restriction under the Coastal Wetlands Restriction Law. CZM provides statewide standards for protection of coastal wetlands, insuring some consistency.

In 1980, the Massachusetts CZM program reported 817 orders of conditions were received by Conservation Commissions within this coastal-zone area. Appeals totalled 87, with the preponderance from applicants (46) but with a substantial number (28) by DEQE. In 1981, these coastal permits issued totalled 1,006, with 104 appeals. Program reviewers noted the tendency of conservation commissions in coastal communities to reduce the permit load by use of the "Determination of Applicability/Non-Applicability". Through this mechanism, towns attempt to weed out "minor" projects by determining the significance to the interests of the Act, thus saving time and money. Over 300 determinations of non-applicability were issued in 1981, with 76 in the town of Bourne alone (see Massachusetts Appendix).

Another filter for wetlands permit processing is the MEPA process (see Wetland Laws). In "Comprehensive Review of the Massachusetts Environmental Policy Act" (Barry J. Reed, prepared for Massachusetts Audubon Society, Lincoln, MA, April 1981) the researcher studied 1,003

files from February 1978 to January 1981 at the state's Executive Office of Environmental Affairs. Of the 17 categories of activities, a total of 469 projects involved jurisdiction under the WPA (this figure, however, includes projects on beaches, floodplains, etc.), only 119 of these were coastal. Also, only 60 of the total 469 were before MEPA solely because of the Wetlands Act, which requires review of all projects affecting more than one acre of the area covered by the WPA, including the 100-foot buffer. That is, the majority of the projects reviewed involved other state permits and funding which "trigger" MEPA review. DEQE estimates the MEPA reviews about 9 percent of all projects for which DEQE issues superseding orders on appeal under the WPA. The following Table 4 shows the breakdown of those 469 projects according to type of activity (this does not of course tell us about the acreage involved). Road projects, housing and inland water projects (defined as dredging, bank protection, dams, water supply) lead the group in 1981, with sewage sludge projects rising. Other MEPA data includes a memo from the Massachusetts Forest and Park Association, a Boston non-profit group, relating to categorical exclusions from the MEPA process proposed for projects reviewed by DEQE on appeal: In a study of MEPA files 1978-June 1981, focused on housing, industrial projects and shopping centers, the MEPA samplers concluded that about 17 percent of the housing projects before MEPA had as their only permit a DEQE Wetlands Order (only 2 out of 45 sampled from 150 projects were required to do an EIR). Another study of wetlands files at MEPA resulted in a letter dated February 2, 1982 from the Executive Director of MEPA to the Commissioner of DEQE indicating that of 378 files studied October 1980-September 1981, 201 involved orders of condition under the WPA. Of these

Table 4. Selected* Wetland Permit Applications by Project Type and Project Location FY78, FY 79, and FY80 Massachusetts MEPA and DEQE, State as a Whole.

	Applications					
	Inland		Coastal		Total	
Type of Project	No.	Percent	No.	Percent	No.	Percent
Residential	76	21.7	8	6.7	84	17.9
Roads	80	22.9	9	7.9	89	19.0
Commercial	33	9.4	0	0.0	33	7.0
Industrial	40	11.4	1	0.8	41	8.7
Recreation	8	2.3	4	3.4	12	2.6
Public Service**	57	16.3	16	13.4	73	15.6
Coastal Water***	0	0.0	79	66.4	79	16.8
Inland Water	43	12.3	0	0.0	43	9.2
Other	13	3.7	2	1.7	15	3.2
TOTAL	350	100.0	119	100.0	469	100.0

*Adapted from Table 7 of "Comprehensive Review of the Massachusetts Environmental Policy Act" by Barry J. Reed, Massachusetts Audubon Society, April 1981. These are all "larger" projects of one acre or more. Although the table includes 60 projects reviewed by DEQE prior to MEPA, the other 409 are MEPA projects initially determined to require an Environmental Impact Review.

**"Public Service" consists of Reed's categories "Solid Waste" (21), "Sewage-Sludge" (38), "Institutional" (4), "Schools" (6), and "Airports" (4).

***While not confirmed, it seems clear that "Coastal Water" is a catch-all category into which probably fell many industrial, commercial, road, and other types of projects.

20 involved some fill in vegetated wetlands, and of these a total of five could not have taken place as planned without fill in vegetated wetlands: a commercial building, a parking lot, a sanitary landfill, an erosion control project and a regional shopping mall. Thus only 10 percent of this sample of DEQE Orders involved wetlands filling.

To supplement these bits of data regarding the WPA and other laws, a researcher sampled files from 3 of the 4 regional offices. Very little data is generally available except current files (last year or so) and very old permit files microfilmed in Boston (1965-1972). The following section of this report shows the trends in percent of permits relating to work in vegetated wetlands; appeals and who appealed; and denials (information not otherwise obtainable at all).

3. Analysis of WPA Permits

A. Methodology/data Constraints

Although the data obtained from permit files are severely limited from a quantitative view, some qualitative impressions about the wetlands program can be supported.

Throughout the research for this project, there were several problems with collecting and analyzing the data. Most obvious is that fact that the huge number of permits granted over the life of the program obviates the possibility of reviewing all the permits, given the time constraints. The only existing analyses of the permit program have been noted above, and therefore a sampling effort was necessary. Although the application for a wetlands permit (called a Notice of Intent) is filed by the applicant to the local Conservation Commission, copies are also provided to the

appropriate office of DEQE. There are 4 such regional offices, Western, Central, Southeast, and Northeast, where records of the permit activity for each application are collected in files. Each file is numbered and includes at a minimum the notice of intent (application), plans for the proposed project, and the order of conditions (approval or denial) issued by the conservation commission. Any correspondence related to the project, appeals, superceding orders of conditions from DEQE, and environmental notification forms and other data resulting from the MEPA process are included if generated.

The vast majority of the files are inaccessible for the purposes of this project, as records of the older projects are stored in cardboard boxes either in the offices, or in the state record facility. Availability of files varies among the regional offices as noted below. In addition, the ease and accuracy with which vegetated wetlands cases could be identified varies with the record-keeping system of the offices. The quality of the notice of intent and accompanying plans was a major factor in the evaluation of a proposed project. Often, the amount of wetlands affected was not stated; whether an activity would actually take place in or near the wetland, and what alteration of the wetland was actually proposed remained obscure. For example, blueprints and specifications frequently omitted the location of wetlands, acreages of wetland were unclear, and therefore the relationship between the activity and the wetland was often difficult to assess. With the exception of the early permits in the 1960s, the word "fill" never appeared in the description of a project, presumably because the applicants feared that explicit reference to filling wetlands would adversely affect project

evaluation.

Sampling of the files was carried out at the Western, Southeast, and Northeast regional DEQE offices. The Central office was not visited because phone contact with DEQE established that the only target town (see below) within the district, Petersham, had negligible permit activity. Consistency in data collection from DEQE was hampered by the varying record-keeping systems of the regional offices. The Western regional office contained all files for permit activity during at least the last two years (late 1979, 1980-82). In addition, the log book specified type of wetland (floodplain, stream, open water, etc.) simplifying the task of identifying vegetated wetlands. In the Southeast region, current orders of condition and many appeals are kept available. Because the current files were incomplete and the appealed cases all by definition indicate some degree of controversy, the Southeast files do not offer an objective collection from which to sample. Retrieving files of vegetated wetlands was greatly facilitated by verbal identification from the staff. The Northeast region retains in their files only active cases. Therefore, most did not have final resolutions indicated. In addition, cases which involved vegetated wetlands could only be determined by studying the project plans. Few cases were reviewed in the Northeast area, simply because there were few completed files and a limited number involving vegetated wetlands.

Because of the necessity of limiting the number of permits sampled, and in the hope of correlating permit activity with physical changes under investigation separately, particular towns were designated for review of permit activity. Originally towns to be studied corresponded

with those researched by John Organ, U.S. Fish & Wildlife Service, in order to compare institutional trends with physical trends. The 15 towns studied by Mr. Organ are Amherst, Barnstable, Braintree, Concord, Florida, Newburyport, Petersham, Sandwich, Sheffield, Southampton, Topsfield, Westport, Weymouth, Whately, and Wilbraham. Due to the paucity of records available in the Northeast DEQE office, Braintree, Newburyport, Topsfield, and Weymouth were not investigated. Barnstable was omitted because the large volume of permit activity precluded review within the time constraints and Petersham, as noted previously, was disregarded on the basis of little activity and the necessity of an additional site visit. Replacements were added at the suggestion of DEQE staff on the basis of evidence of relatively high volume of permit activity relating to vegetated wetlands. Thus, the final list of towns chosen for sampling is as follows:

	Organ town yes/no	DEQE region
Agawam	no	W
Amherst	yes	W
Billerica	no	NE
Concord	yes	NE
*Florida	yes	W
Foxborough	no	SE
Mansfield	no	SE
Raynham	no	SE
Tewksbury	no	NE
Sandwich	yes	SE
Sheffield	yes	W
Southampton	yes	W
Westport	yes	SE
Whately	yes	W
Wilbraham	yes	W

*Florida has yet to have a wetlands permit (6/82).

These towns do include a range of geography, population, development pressures, and sensitivity to environmental issues. However, it must be stressed that the towns investigated are not representative; the selections were intended to provide data comparisons and do not provide a statistical record of permitting activity that can be extrapolated with any confidence. However, the cases sampled do reveal trends in activity in the chosen towns.

Research began with the intention of comparing the more recent records for these towns with the old "P-files" from 1966-1972 of cases reviewed before the conservation commissions became the first step in the program. These records are preserved or microfilmed in Boston, but, because many lack plans, it is hard to determine what the applicant actually proposed to do, and how his activity would affect a wetland. In addition, many of the target towns were not represented, or involved only buffer or floodplain issues. This information will support only a few observations about changes in the program.

A review of the first 400 P-files from 1966-1967 yielded evidence of activity in vegetated wetlands in only 5 of the sampled towns (Agawam, Concord, Foxborough, Mansfield, and Tewksbury). To increase the sample, three towns (Braintree, Attleboro, and Stoughton) were added because they were the site of some of the major cases (see Section 5).

In all cases, information extracted is only as reliable as the information submitted by applicants. In straightforward cases, an uncomplicated project, with no appeals, the data are suitable for a tabular format. Where the project was complex and/or controversial, the data are included in narrative form. However, the analysis of the data includes both simple

and complex types of projects. For an analysis of the largest projects involving wetlands showing the variety of proposals and outcomes, see the section on major cases.

B. Analysis of Sample

The sample of 55 permits from 14 communities from which this analysis has been drawn are from a review of more than 200 files. The research was concentrated on vegetated wetland fill cases. Obviously due to the breadth of circumstances covered by the statute, only a fraction of cases were of interest. Where wetlands were identified by type in the DEQE Regional offices such notations were used and therefore the percent of vegetated wetlands suggested by the sample is too high. The exact proportion of WPA activities attributable to vegetated wetlands could not be determined from this study. Estimates from contacts with DEQE staff indicated that about 10 percent of the total permit activity affected vegetated wetlands (see Table 3a for Western Mass. Region data).

The largest number of filings (39%) under the WPA were the result of housing construction (Table 3a). Single-lot houses and multi-lot subdivisions were about equally represented; however, subdivision projects tended to affect wetlands on only a fraction of the total number of new lots and therefore did not appear to be more disruptive than single home building. In most cases the disturbance of wetlands appeared to be minor. Cases of the filling of an entire lot for the purpose of making the site suitable for a home were not detected in this sampling effort. However, 5 percent of the cases were for septic systems, and might

justifiably have been classified "housing" also.

Industrial/commercial developments constituted 21 percent of the types of projects identified. Although it appears that larger amounts of wetland area were involved than with housing, it is again difficult to determine the actual effect on the wetlands from the plans. However, conservation commission members and DEQE, with the benefit of site inspections, appear to have been able to specify provisions intended to minimize damage. Industrial/commercial sites involved large acreages and apparently enough extra space to provide mitigative measures or to relocate parts of the development. Mitigation measures include wetland creation, retention basins, sedimentation and erosion control, fish habitat protection, improving existing wetlands, requiring buffer strips, groundwater monitoring, and drainage systems for run-off control. Because industrial/commercial projects involve professional engineers, many alterations could be avoided in the design stage due to familiarity with the act. DEQE personnel all cited the familiarity of engineers and planners with the provisions of the act as a major factor in increasing cooperation and compliance.

Although highway and road construction accounted for only a small number of cases in this sampling (as opposed to Western Mass. data in Table 3a), the area of wetlands affected tended to be quite large, ranging from 5 to 90 acres (5 cases or 9% of the sample). Segments of the interstate highway system which have been constructed in recent years were generally planned and designed before wetlands issues were considered. In two large projects involving gravel excavation for I-495, conservation commissions' orders of condition contained denials, but the denials related to ancillary activity, with no effect on the location of the highway. The destruction of wetlands to complete a highway apparently regarded as a fait accompli. When the notice of intent arrives DEQE staff concede that little attempt is made to interfere.

The only other project type classified in this sample was 10 percent for agriculture or silviculture. The remaining 16 percent were in scattered categories.

It is impossible from the sample to determine which type of projects were most likely to result in appeals, because the data consisted of a disproportionate number of appealed cases. In agreement with the data for the DEQE regions (see Table 3) the appeals are most frequently made by the applicant (15), then by citizens (11), with a small number of DEQE interventions (2). However, it is not clear what percentage of appeals were justified on the basis of wetlands concerned. The regional offices all felt that a majority (ranging from 50% to "most") appeals represented bona fide wetlands issues, with the remainder being attempts to prevent development or outgrowths of neighborhood squabbles. DEQE staff reported no correlation between the importance of a wetland qua wetland and the likelihood of an appeal of the conservation commission's order of conditions. The ability of parties to pursue an appeal instead seems to be based on the financial resources of the applicant or objector and/or the amount invested in the project.

To provide a perspective on changes in the state program over the fifteen years since its inception, an attempt was made to review some of the old P-files from 1966-67. Although the effort to save records at all was commendable, the data were in poor condition for sampling: ordered only by permit number, plans missing, presence of vegetated wetlands uncertain, and proposed activities unclear. From some of the letters included from confused applicants, it appears that public understanding of the program has improved considerably. One striking

difference between the old and newer files (although this may only be a question of semantics) is the frequency of the word "fill", in the sixties, everyone wanted permission to fill something, but by the mid-seventies to the present, euphemisms abound (grade, level, excavate and deposit etc.). There are insufficient data to provide a comparison on the basis of the relative activity levels in these towns at the beginning of the program to the present. Generally, fewer conditions were noted, and commonly the only special condition was for compliance with the state sanitary code. Subdivisions and industrial/commercial developments predominated as types of projects. One permit was apparently denied, in Concord, although the decision seems to have been influenced by a conflict between land slated for a subdivision and the town's plan for open space acquisition.

Two observations offered by DEQE personnel are important from the standpoint of assessing wetlands trends but unfortunately could not be confirmed or denied because of the inadequacy of the data. One is that the projects are now smaller and better designed to accommodate wetlands sites than was the case 10 years ago. The second is that orders of condition are far less likely to be abused, as public acceptance, sophistication of conservation commissions, and enforcement have increased. The need for a certificate of compliance showing that the project was completed according to the specifications of the permit, was noted as one reason for compliance.

Of the seven interests of the act, flood control and water supply protection, both surface and subsurface, were most frequently cited as areas of significance. These were by far the most common noted in

appeals of conservation commission orders of condition, but often the decisions at the local level did not appear to correspond directly to the protection of one or more designated interests; conservation commissions often do not refer to specific interests of the Act as the basis of their judgements. Because the issues are based primarily on hydrology, wide variation in the sophistication (and presence of professional staff) is reflected in the quality of the orders of conditions. DEQE decisons on appeals cite the interests protected explicitly and provide supporting considerations. The preponderance of cases reviewed by the state also involve flood control or water supply issues.

Few projects in the sample were permitted without any extra conditions added on to the boilerplate material. They ranged from what amounts to "best management practices", such as the placement of hay bales to control sedimentation, to provisions which would require substantial alterations in the project proposal. The number of conditions varied from 0 to 30 or more, with an average of six. There does appear to be a positive correlation between the number of conditions and the size of the project; however, even the most minor activities were likely to have extra conditions imposed.

Although any one town can not be construed to represent the situation in the state as a whole, a few comments about wetlands activity in Amherst indicate some of the general features of the program. In a period of two years, there were 28 filings, but apparently only four affected vegetated wetlands. Of these, only one involved any fill, and only a small amount, for the construction of a narrow road and pipe to a town water supply located in a swampy area. The others were minor

ditch clearing or drainage pipe installation. As reported by DEQE staff in all regions, the majority of the filings resulted from work proposed in the 100-foot 'buffer' and did not include any activity in the wetland itself.

The data on wetlands activity show the creation of ponds as an important trend: the wetland is not technically eliminated but its status is certainly changed. Seven of the 55 filings reviewed entailed pond construction, or 12.5 percent of the sample. However, the number is undoubtedly much higher because pond projects were commonly characterized as relating to "open water" rather than to vegetated wetlands and therefore eluded the sample. The environmental effect of this trade-off is unclear, but impoundment may be a serious threat to survival of productive wetlands, the small dam program of the Soil Conservation Service under Chapter 566 being an example of often trading off wildlife habitat values for human recreational or flood control values. (Of course open water is fine for some species also.)

There is no clear state policy on alteration of vegetated wetlands to open water. Some local and state people worry about loss of flood storage and damage to water quality; many are, on the other hand, more agreeable towards this form of "alteration" than towards other activities. Everyone worries a lot about the disposal of the dredge spoils. Some developers will use "pond restoration" as an excuse to dump fill on adjacent wetlands and make them developable; others try to use pond dredging to lower the local water table to destroy nearby wetlands. Wildlife values are not supposed to be considered under the state wetlands act, except for fisheries and shellfish (though they often are).

4. Cases Involving Major Wetlands Work

A review of fifteen major WPA projects in Massachusetts illustrates the roles of local conservation commissions, the state DEQE and the Corps in regulating the use of wetlands. The information differs in comprehensiveness and case to case consistency due to varying quality of

sources. These cases were selected because each involved relatively large amounts of fill; although some have resulted in considerable controversy, they were not chosen on that basis. The cases are representative in that they reflect a range of project types: almost one-half (7) were industrial or commercial, two involved housing, two were for recreational purposes, two were highway or road projects, and two were for mixed purposes (highway/recreation and commercial/recreational). Three of the projects were withdrawn from consideration by the applicants after alterations were required as a result of the permit process; however, there is no good evidence of cause and result. For six projects, the files are currently active or the final disposition of the project has not yet been made.

A preliminary observation, which is supported by discussions with agency personnel and the larger sampling effort, is that projects that were permitted before the involvement of conservation commissions or with an inadequate early permit tend to cause trouble. Two such projects, D'Annolofo's and E & T Maher, were allowed with inadequate conditions imposed. Where destructive activities are carried out legally, DEQE has difficulty trying to stop work or alter the plans. Many permits issued in the 1960s had neither any specific conditions nor any termination date.

The role of the conservation commission is difficult to assess from this overview of important cases. Three projects were denied in orders of condition issued by the conservation commissions and applicants appealed. What DEQE would have decided about these denials is unknown because all three had to go through the MEPA process (see legal section) and were later dropped. The significance of this chain of events is unclear. It can be concluded that conservation commissions are thorough in reviewing large projects, as evidenced by a large number of extra conditions imposed on the activity. The pressures on conservation

commissions may be seen in two occasions where the order of conditions was amended by the conservation commission after appeal by a dissatisfied applicant for a major project. Amended orders of condition were rare indeed in the sampling of all projects. Whether the amendments resulted from negotiations over the nature or extent of the project could not be determined.

The state intervened in the two projects with amended orders and one other which had simply been approved by the conservation commission. The DEQE can take jurisdiction in the absence of an appeal when it determines that the interests of the act will not be protected. From the larger sampling (see Table 3) it is evident that DEQE intervenes on the average with less frequency than this 3/15 ratio, reflecting a higher degree of concern with larger, and potentially controversial, projects. Intervention can cause resentment at the local level. (For further discussion of the relationship of DEQE and the conservation commission see local roles section.) Unless the MEPA process is triggered, DEQE appears to play the most active role in wetland regulation.

Almost half of the projects (7) involved MEPA review by EOEA, although EIRs were not always required and in one case for a categorically included project the EIR was waived (Kingston Mall). In three cases the project was dropped prior to the EIR stage. A superseding order of conditions can only be issued by DEQE after the MEPA process is complete. The contribution of MEPA is unclear from these cases, although people involved report that the process helps to make projects more acceptable from a wetlands protection viewpoint, and relieves DEQE of some investigative responsibility. Some MEPA staff feel that DEQE does not give

sufficient consideration to their recommendations. Eventually, however, the onus of allowing or denying a project falls on DEQE.

It appears that the Corps complements the role of DEQE, adding expertise, clout, and jurisdiction. The Corps was involved in seven of the fifteen cases, representing a far higher percentage of activity in these large projects than in the larger pool of projects. Of these situations, Corps involvement appears to have been routine in 2 instances, to have provided considerable expertise in a third (Bourne Marina) and resulted from an enforcement procedure due to illegal activity in a fourth (Mansfield pond restoration). More importantly, two of these seven cases (D'Annolfo Industrial Park and Attleboro Mall) are among the extremely infrequent (see Corps section) instances in which the Corps has claimed discretionary authority for work authorized under a nationwide permit; (Easton Mobile Homes is currently under consideration). In the Attleboro case, a better-late-than-never situation, the Corps' decision serves to support DEQE's denial of the project. The D'Annolfo case, where the old order of conditions made DEQE control over activities on the site difficult, constituted a clear Corps jurisdiction. While these cases involving discretionary authority are unusual and all have yet to be finally resolved, the Corps program appears to augment the state program.

The cases are described below:

The Kingston Mall (DEQE #37-666). This case involved a proposal for a 300,000-500,000 square foot commercial development. The project included the excavation of more than 80,000 cubic yards of peat from a wetland and cranberry bog which would then be filled. Almost 80 acres

would eventually be covered with asphalt.

In January 1980 the Kingston Conservation Commission issued an order of conditions including provision of a retention area and specifications to protect the town well site less than 1000' from the site. Although the order was appealed by 10 residents of the town, the applicant was not notified, and began work which was ordered stopped. Because of the procedural issue, the applicant challenged DEQE's jurisdiction, but this was confirmed by DEQE. In the meanwhile the conservation commission amended its order of conditions on January 10, leaving only 8 extra conditions after removing the ones aimed at protecting the well site.

The ENF completed by the applicant stated that the project involved the fill of two wetland areas of 0.7 acres and 3.8 acres, and that the project total was 70 acres. In July 1980, it was determined that an EIR was required under MEPA, a categorical inclusion because of the wetland fill acreage. However in October 1980, the categorical inclusion requirement was waived by EOEA. This controversial waiver led to formalizing of the waiver requirements.

In November 1980, a superseding order of conditions was issued by DEQE. There were ten extra conditions including the construction of a sewage treatment plant, a prohibition on discharge within the cone of influence of the town well, controls on run-off, and other measures to protect the well.

North Stoughton Village (DEQE #298-35) was a proposal for low and moderate income housing. The project involved 10 acres, with 5.2 acres of wetlands directly affected. An order of conditions was denied by the

Stoughton Conservation Commission and the applicant appealed. A superseding order by DEQE had to await a MEPA ruling. A 1979 ENF led to a MEPA conclusion that an EIR was required. The opinion was also offered that a 1978 ENF submitted to the Massachusetts Home Finance Agency was seriously deficient in stating that none of the site was wetland.

The applicant modified the project so that wetlands would not be affected, reducing the number of units from 144 to 98. An EIR was no longer required, but the applicant dropped the project. DEQE staff believed that the project was dropped because of financial reasons. Costly and time consuming engineering studies would be necessary for a project of this size in the proposed location to be permitted.

The Attleboro Mall (DEQE #97-37) was proposed for a 75-acre site including 45 acres of wetlands. The Attleboro Conservation Commission imposed 37 extra conditions on the project on April 16, 1979, an extremely large number even for a large project. Safeguards included monitoring, retention areas totaling 56.7 acre-feet for compensatory storage, and a $20,000 bond There was also a provision for revocation of the permit if there was evidence of deterioration of ground or surface water quality or increase in sedimentation. On April 26, 1979, the mall construction was allowed by the Corps with a nationwide permit.

The order of conditions was appealed by 10 residents, including 2 abutters, based on legal issues, errors and inconsistencies in the Notice of Intent. The project went through the MEPA process; in September 1981 DEQE Wetlands Division recommended to MEPA that the project be denied. Intervention by the Corps was requested by the Rhode Island Department of Environmental Management. The Rhode Island Department of Environmental Management requested intervention because of concern over water quality issues. The project site is less than a mile from the Rhode Island border and a potential water supply reservoir. In November 1981, the Corps exercised its discretionary authority requiring an individual permit stating that the project entailed much more than

"minimal impacts". Interstate commerce was not a specified justification for involvement in this project. The Corps cited the size of the project and potential effects on water quality and on the aquatic environment as grounds for asserting discretionary authority.

On April 20, 1982, DEQE issued a superseding order of conditions denying the project. The compensatory storage was considered insufficient, with questions about the capability of man-made systems to equal natural systems. Three interests of the Act were cited as threatened: 1) groundwater supply because of retention ponds lowering the water table and paving eliminating recharge; 2) damage to fisheries; 3) pollution from run-off.

The Mansfield Pond Restoration project was denied by DEQE in October 1977 without prejudice with a request for additional information. The site, part of a river, was once a 10 acre pond created by control structures, but had reverted to wetland. In April 1980, the Mansfield Conservation Commission issued an order of conditions allowing the project but requiring the following before the start of work: dam inspection, erosion and sediment control plan, and the delineation of existing vegetated wetland boundaries and of the location of access roads. The project was part of the town master plan and the state did not intervene. A cease and desist order was issued by the Corps because a permit had not been obtained. A permit was granted by the Corps, but United States Fish and Wildlife indicated its opposition to the project.

Unicorn Realty Trust (DEQE #31-88) involved a proposal for commercial buildings, 125,000 square foot warehouse and 15,000 square foot office space. The project would entail grading, dredging, a retention pond and a total of 42,000 cubic yards of fill. In Hanover, the site covered 15.42 acres with 7.16 acres of vegetated wetlands, as well as 7 acres of vegetated wetland in Norwell. The Hanover Conservation Com-

mission denied the project in its order of conditions because the amount of runoff projected might increase flooding and pollution; the commission was also guided by an environmental quality bylaw. An ENF specified that 14.18 ± acres of vegetated wetland should be affected, so a decision from MEPA was necessary before a DEQE superseding order. The Hanover Conservation Commission registered a complaint with EOEA over the runoff estimated by Unicorn Realty on the ENF.

An EIR was required as the project was presented. Two options were outlined: submit an alternative design for a conservation commission order of conditions or submit a new design to MEPA to determine whether an EIR would be required. The project was dropped.

The next two major cases resulted from the construction of I-495 through the Southeast portion of the state, involving extensive alteration of wetlands. The highway was designed in 1963 as part of the federal interstate system. An EIS was completed early in the 1970s, soon after the passage of NEPA. Orders of condition were issued for each town as construction proceeded. Due to the nature of the project, DEQE has not attempted to intercede in the basic dredge and/or fill needed to complete the highway as planned. However, the files reveal that DEQE maintained at least a supervisory role.

Mansfield I-495, 1979-80, involved a 29.9 acre site gravel removal for highway construction and the excavation of a pond. The Mansfield Conservation Commission order of conditions had protective specifications but also provisions that there be no future development on the site. The order was appealed by the applicant, and the Conservation Commission amended it so that further development would be allowed. The appeal was then withdrawn but withdrawal was not accepted by DEQE. Determining that the project was significant to the interests of flood

control, storm damage, fisheries, and pollution, the superseding order from DEQE specified a sediment control procedure and a prohibition on discharge of suspended solids into the river.

A project for I-495 in Raynham combined highway construction and town recreation. Earth material was to be excavated from a 92 acre swamp area and used as a fill for the highway. The project was recommended by the Bristol County Mosquito Control Project due to fears over possible outbreaks of encephalitis. The excavation was to eventually produce a pond for recreation; the money for the upkeep of the recreation area was to be obtained from payments to the town for the fill removed. An order of conditions was denied by the Raynham Conservation Commission, citing several substantial reasons. The applicant appealed, DEQE requested further information before issuing a superseding order, and the MEPA process was triggered. The applicant dropped the project.

Plum Island Town Road is affected by both the coastal wetlands restriction program and the Wetlands Protection Act. This primary access road is subject to frequent flooding and needs to be rebuilt. On both sides of the road are saltmarsh; about 6/10 of an acre would be directly affected by the construction. The project needs a waiver under the coastal restrictions program. The Northeast Regional office of DEQE was uncertain as to the procedure but expected the project to be reviewed by EOEA to determine whether a waiver should be granted.

Messina Shopping Mall, Pearl Street, Braintree involved a small amount of wetland in comparison to the Kingston or Attleboro Mall projects but the site had a history of problems with flooding. The Braintree Conservation Commission Order of Conditions was appealed by the

applicant to DEQE. On review, the MEPA process was triggered and an EIR was completed. The final order by DEQE was recently issued, with some changes from the original project design.

The Wellfleet Harbor Dredge Disposal project led to both state and federal involvement. Part of the activity was carried out by the Corps as dredging of a channel for major navigational improvements in the town harbor. The Corps' work in the federal portion of the channel resulted in sand removed by dredging, a "clean" material for disposal. However, a local project for work on the town pier had more serious disposal problems due to the muddy bottom near shore. A proposal to dispose of the material by filling 5-10 acres of marsh was approved by the Conservation Commission. However, DEQE intervened in the case and appealed. The original site is no longer being considered for a disposal site, at least not without mitigative measures. At this time, the disposal issue has not been resolved.

The Easton Mobile Homes project is for a trailer park on a site with 8 1/2 acres of affected wetlands. An order of Conditions was issued by the Easton Conservation Commission, followed by an appeal to DEQE. An ENF was completed for the MEPA process; the project is now in the scoping stage. According to the Corps, the project has been reduced to 6 acres. The project falls into the nationwide general permit category. However, the Corps is waiting for a decision by the state before considering the option of discretionary intervention.

Bourne Marina is a cooperative project, with joint funding of the town of Bourne and the Massachusetts DEQE Division of Waterways. The plan is to build a marina in an area anxious for the business by

excavating an inlet and fringe phragmite saltmarsh. There was no review or order of conditions from the town conservation commission because the project had been excluded under a provision of the WPA exempting projects authorized before 1972. Both DEQE and the Corps investigated mitigative measures. A specialist in saltmarshes from the Corps' Coastal Engineering Research Center in Virginia inspected the site. The applicant agreed to a program of transplanting vegetation from the areas to be removed to an adjacent eroding area, resulting in a net increase in marsh and aquatic habitat.

The conditions of the permit required the establishment of marsh in specified areas within two years. Extensive technical assistance was provided by a Corps wetland specialist from Virginia. The Corps continues to monitor the project and reported encouraging results from this spring's fertilizing.

E & J Maher Co. has been operating in North Reading along the Ipswich River under a WPA Order dating from the 1960s. There were insufficient conditions specified and no termination date. Activities have included an enormous amount of dredging within the flood plain and the stockpiling of peat. There is no evidence of Corps involvement. Apparently the E & T Maher Co. project predated the Corps program. The Corps reported that it does not interfere in projects with valid permits. Because of the lack of a termination date and a valid if inadequate permit, DEQE has had difficulty dealing with the situation. Presently there is a proposal for a building on the site; DEQE is considering a trade-off allowing the construction in return for strict conditions on the rest of the property. There remain problems at the local level with zoning, variances, etc., so the situation is unresolved at this time.

Leonard Silver and Manufacturing (a Divison of Towle) involved a proposal for industrial development on 45 to 50 acres in Revere, Massachusetts. The site had been proposed for use many times but had remained vacant due to physical problems. The area has 650 acres of upland drainage which runs into a drainage ditch across the property with

discharge into a tributary of a tidal river. The tide gates had not been functioning for several years and abutters had had problems with flooding. Leonard Silver repaired the tide gates and, based on a study of the hydrology of the site, proposed increasing the depth of the ditch. This action was supposed to alleviate flooding in smaller storms and at least not aggrevate the situation in larger storms.

The Revere Conservation Commission approved the project. Apparently the decision was not appealed. DEQE dio not intervene. A Corps permit was necessary because of the tide gates. EPA expressed some objections to the project on grounds that a portion of the site had been saltmarsh. This view did not prevail because the site was so far from its historic condition.

D'Annolfo's Industrial Park, Woburn is a project on a site with a history of misuse. Work was carried out in the area under an order of conditions from the 1960s issued by the Department of Natural Resources, with inadequate conditions imposed. Because of previous land use, construction involving earth moving led to breakage of dikes and problems with arsenic, chromium, other heavy metals and odor from hides from old tannery activity. In 1979 EPA and the town of Reading sued the owner over the odor issue. Also in 1979, the Corps determined that significant water quality problems existedbut that the site fell into its headwaters' nationwide permit classification under s. 404. The Corps then decided to claim discretionary authority and require an individual permit, a rare jurisdictional assertion. Presently, the site is under a consent decree, awaiting further planning. One proposal is to allow development of sections after the clean up of other sections. Funding is a major problem.

5. The Local Role

Two hundred forty-eight local conservation commissions administer the WPA on the first level of regulation (in other communities the chore is handled by the selectmen or mayor). Their power, interest, expertise and the pressures upon them vary widely; a few communities have never held a WPA hearing in 10 years. It is not possible to estimate the job the people are doing from existing data. Most DEQE regional engineers think some communities are too soft, or inefficient, while others over-regulate, treating the WPA as if it were simply a law prohibiting fill in wetlands. The regional engineers' offices and Rod Gaskell, Director of DEQE wetlands division, agree that there is no obvious correlation between the seriousness (in terms of size of wetlands work or sensitivity of wetland) of a proposed project and the likelihood of its being appealed; neighborhood disputes or major problems with a large project are just as likely reasons to trigger an appeal. For many projects, especially in communities without site plan review or Special Permit proceedings under zoning, the WPA provides the only public hearing forum; nonwetland concerns are bound to intrude in such cases.

Over 200 of the state's 351 communities have some kind of floodplain zoning; FEMA estimates that a great majority of the wetlands (up to 95 percent) could be included in such a regulatory district if extensive, i.e., if the community chooses to regulate all the floodplains in the community. (In order to quality for the flood insurance program, FEMA demands regulation of only the major 100-year floodareas.) However, such regulations generally focus on flooding concerns, including qualifying for flood insurance under FEMA; thus wetlands might not be of prime concern in giving out permits. In the 101 city and town districts comprising the regional planning area of the Metropolitan Area Planning Council, 54 towns and cities had floodplain zoning and 35 had wetlands protection zoning in 1980 (MAPC analysis of zoning; MAPC, Boston, July 1980).

Although a number of sophisticated communities have expressed informally their belief to the Massachusetts Association of Conservation Commissions (MACC) that the adoption of the local bylaw has greatly cut back on attrition of wetlands in their communities, this is not possible to quantify without a separate study, since the effect relates in large part to a reduction of permit applications. Prospective applicants may become discouraged at sheer multiplicity of permits when not only the conservation commission (frequently not a powerful body in local politics) but the total 'apparat' of the town is arrayed against work in wetlands.

A profile of wetlands regulation in coastal Massachusetts towns by T. M. Leschine (Woods Hole Oceanographic Institute) and S. R. Cassella; prepared during 1979 under a NOAA Sea Grant, compared Falmouth, with much saltmarsh and Marshfield, with much freshwater wetlands. The Falmouth Conservation Commission had processed only 150 permit applications of all kinds from 1972 to mid-1979; Marshfield less than half as many. The researchers perceived that "systematic evasion of permit requirements for relatively small scale activity at least (such as dock and rip rap installation) is widespread in Falmouth." It was not possible to tell how much of the permit activity impinged on vegetated wetlands. Leschine rejected the hypothesis that the WPA was restricting overall growth in the housing industry on Cape Cod, on the basis of his study of Falmouth, Orleans and Eastham. He also agreed with the judgement of virtually all DEQE personnel that almost 2/3 of the persons interviewed had no clear idea of WPA jurisdiction and that "wetlands

protection can become an excuse used to legitimize a host of other social and economic concerns." In 1981, by contrast with this study, Falmouth held 170 hearings on Notices of Intent and Determinations of Applicability. Falmouth conservation commission member Marcel Kistin believes that the conservation commission has raised consciousness within the town, notably by twice publishing in the local paper a description of the law, its jurisdiction, and the fines and penalties for breaking it. The correct number of Falmouth 1981 hearings and determinations was 170, nearby Barnstable held 248 that year! The Leschine study states that researchers "cannot yet judge" the level of enforcement in Marshfield, as opposed to Falmouth. The study shows no intent to adduce that permits were denied in Marshfield.

A survey of conservation commissions sponsored in 1980 by the MACC is still in process. Of 43 responses to 348 questionnaires (a sample believed by the researcher to show a good cross section of commissions), preliminary sampling shows a profile of a high-level professional conservation commission in terms of budget, staff, mapping of wetlands, availability of legal expertise, adoption of zoning/nonzoning wetland bylaws, correlating positively to number of orders of conditions issued. This agrees with our own research of DEQE files: the many orders issued does not necessarily mean a lot of filling being allowed; it may instead mean a keener eye for minor violations. The rising tide of DEQE permits under the WPA may indicate the same thing, rather than more proposed filling of vegetated wetlands.

6. Army Corps Involvement in Massachusetts

Rod Gaskell, Director of Wetlands Division of DEQE, estimates that approximately 60 percent of the surface area regulated by DEQE is or

should be subject to section 404 jurisdiction. This would not imply that the COE should be processing 1,800 permits, however, because of the regional general permits. The figure represents only an estimate that 40 percent of the state's wetlands may be exempt under the nationwide permit for activities above headwaters or on isolated ponds. He points out that the 404 program permits consideration of wildlife habitat, which WPA does not (although it does cover fisheries and shellfish); he also feels the COE can do a more thorough review. He feels that the COE jurisdiction should not be cut, especially since loss of CZM funding may lead to cutting DEQE office budget in half, thus decreasing its effectiveness. In addition the COE should retain broad overview authority to monitor general direction of the Massachusetts program.

COE activity in Massachusetts in recent years has represented less than 10 percent of the state permit load. The COE issued 67 permits in FY1980 and 61 for FY1981, in the 404 and 10/404 categories of permit activity. The Corps and Massachusetts have no cooperative arrangements, such as joint application or joint review. A joint COE applicant/Notice of Intent has been devised but implementation awaits resolution of pending proposals to change the state regulations.

NOTES ON PRELIMINARY EVALUATION OF LOCAL OPINIONS: MASSACHUSETTS WETLANDS PERMIT PROGRAM

Introduction

This brief report generally corroborates the findings obtained by survey of the Massachusetts permit program and reported in the preceding Massachusetts portion of this report. It is "preliminary" because we intend to pursue the research to a much greater extent over the next two weeks, in order to provide a more extensive report for the final report of this project. To date only five interviews have been conducted. These will be supplemented by approximately 25 more interviews which will sample developer and consulting engineer opinion in addition to the opinions of local program officials reported here.

Method

The method employed has been quasi-formal in that the interviewer asked a set of 6 predetermined questions. However, interviewer was encouraged to explore on a judgmental basis any provocative responses, and each interview ended with the question, "Are there other persons in your town who might be able to give me pertinent information on wetlands programs or problems in case we decide to pursue some of the responses you have given me?" We believe that this open-ended invitation to name participants on all sides of local controversies may become an important source of information about both the extent of local problems/controversies, and the names of participants on both the regulatory and developmental sides of wetlands issues.

The 6 questions asked were as follows:

1. Tell me about your wetlands problems and programs to regulate their use? Is your program successful? In what respects? Do you like the system of local administration of the program?

2. Do developers or property owners seem to prefer wet to dry land? If so, why? If not, why is there a problem? Do you think it is cheaper to buy and fill a wetland than to buy developable dry land?

3. What is the level of awareness in _____(your community)? Do you believe there is a need for more public education?

4. Do you think there is much "backyard" filling which goes undetected? Do any moderate or large-scale developments escape detection?

5. How fast is your processing system? Do developers complain about the time required to obtain a permit? Do you have any appeals from local Orders?

6. Do you use the state, DEQE or MEPA? Is the state helpful or a hinderance? Are you aware of the program of the Corps of Engineers? Is the Corps program locally known and used?

Interviews conducted to date:

Amherst: Peter Westover, Conservation Officer

Sandwich: Tony Martin, Conservation Officer and D. Steven Collings, Chairman, Conservation Commission

Sheffield: Steven Levine, Conservation Commission member

Southampton: Hazel Young, Chairman, Conservation Commission

Wilbraham: Dorcas R. Roy, Secretary, Conservation Commission

Findings

Following, in synoptic form not necessarily in order of questions asked, is a summary of the most pertinent responses received from each town.

Amherst

Wetlands have been officially mapped and can be overlayed on the Town zoning map. With this official document written into the

bylaw, there can be no argument over applicability. We believe that the program catches all violators, and is 100% successful. We have 50 permits per year and have never had a single case of appeal to the state. It is, of course, conceivable that there could be some undetected small property filling. We are aware that Connecticut has had problems with this and its impact on tertiary streams. However, we have a highly educated constituency, and at least 55% of Amherst's citizens are fully aware of the program. We have a limit of 15 days on processing applications. Wetlands development proposals are a matter of convenience rather than economics. There is plenty of developable dry land available (for a price) in Amherst.

Sandwich

The local program has bugs. For example, the local filing system does not agree with the state's, but DEQE doesn't care. There are sewage problems everywhere in town, including in wetlands. Most proposals are residential and small. Processing time is two weeks. Everyone is aware of the program, and Sandwich has a large number of environmentally-oriented citizens; they do not want to fill wetlands. Our biggest problem is with 3 and 4 lot developments. We haven't dealt with the Corps, only CZM.

Sheffield

Our local program is a fine tool for controlling wetlands misuse, and aquifers also. We average about 1 month processing time. We use the "Cease and Desist" order sometimes, but most citizens are aware. Pressure to develop wetlands results from local policy which

encourages the utilization of marginal land as otherwise "useless". Often, local tax assessors overvalue wetlands, inadvertantly thereby increasing pressure to develop them (in order to justify the carrying cost of high property taxes). However, this is less true in Sheffield (where there is little development, wet or dry) than in some other Berkshire towns like Great Barrington, where there has been considerable controversy involving "Dairy Queen", and Richmond, where the town seems to believe that any development is all right provided it doesn't affect a stream. Town has had no dealings with the Corps.

Southampton

The program has been an unqualified success. We are busy because there are many wetlands, but there are no enforcement problems. There is a need for more public education, especially of newcomers who are less aware of restrictions on use of property they purchase. The only weak link in the system is the Planning Board, but this is not an important factor and is most likely temporary. We take about 21 days for processing permit applications, and we have had 3 appeals to the state. Developers choose to develop wetlands in Southampton because land in Southampton is either wet or rocks. There is little land in between. Town has used Corps on only one occasion with regard to a project involving the Manhan River.

Wilbraham

Wilbraham has a local bylaw which pretty well guarantees that all wetlands proposals will be caught and properly evaluated. The program is an unqualified success. However, there is a problem with

enforcement of the zoning code. Local policing functions are generally unsatisfactory because of staffing problems. Wilbraham has many wetlands, and program personnel are busy. We take between 3 and 6 months for permit processing. There have been two appeals to DEQE. While most citizens are aware of the law, we should have more public education. Developers choose wetlands because there is a dearth of prime-developable dry land. The town is happy with state oversight and uses its expertise. We have had no dealings with the Corps.

MASSACHUSETTS APPENDIX
Selected Material from 1980 and 1981
Coastal Zone Management Reports

EXCERPTS FROM THE MASSACHUSETTS COASTAL
ZONE MANAGEMENT REPORT OF 1980

No. of Determinations of Non-Applicability by Conservation Commissions by Town		221	(See Table A)
No. of Superseding Determinations of Applicability		8	
No. of Notices of Intent received by Conservation Commissions		900	
No. of Order of Conditions issued by Conservation Commissions		817	
No. of Requests for Superseding Orders		87 Total	
From applicant	46		
From abutter	5		
From ten residents	7		
From aggrieved person	1		
by DEQE	28		
No. of Superseding Orders issued by DEQE		68	(See Table B)
No. of Enforcement Actions		7 Total	
Request for Compliance	0		
Orders	4		
Referral to A.G.'s Office	3		
No. of Adjudicatory Hearings Requested by Town		21	(See Table C)
No. of Hours spent per year preparing Superseding Orders*		1,632	
No. of Hours spent per year participating in adjudicatory hearing**		75	

*estimate based on approximate time of 24 hours/Order which includes site-visit, project review, technical data evaluation, etc.
**estimate based on approximate time of 10 hours preparing written expert testimony per hearing and 15 hours of actual hearing time per case. Total 25 hours per hearing.

Table A. Determinations of Non-Applicability

Hull	4	Barnstable	33
Salisbury	1	Bourne	33
Amesbury	1	Brewster	9
Beverly	3	Chatham	21
Danvers	1	Dartmouth	41
Cohasset	1	Nantucket	10
Quincy	2	Orleans	20
Salem	1	Provincetown	1
Eastham	2	Sandwich	13
Edgartown	2	Truro	7
Rehoboth	6	Marion	1
Swansea	4	Marshfield	1
Chilmark	1	Norwell	2

Table B. Superseding Orders

Saugus	1	Eastham	4
Rowley	1	Duxbury	5
Marblehead	1	Provincetown	2
Beverly	2	Bourne	2
Hingham	1	Yarmouth	2
Boston	1	Acushnet	1
Revere	2	Harwich	1
Braintree	2	Dennis	2
Sandwich	3	Fairhaven	1
Marshfield	7	Marion	1
Mashpee	4	Plymouth	1
Barnstable	8	Edgartown	1
Falmouth	6	Norwell	1
Scituate	3	Brewster	1
Dartmouth	1		

Table C. Adjudicatory Hearings Requested

Quincy	1	Marsnfield	3
Falmouth	3	Bourne	1
Eastham	2	Duxbury	2
Scituate	2	Barnstable	1
Yarmouth	1	Provincetown	1
Acushnet	1	Boston	1
Saugus	1	Brewster	1

EXCERPTS FROM THE MASSACHUSETTS COASTAL ZONE MANAGEMENT REPORT OF 1981

Wetlands Protection Program

Data provided by Department of Environmental Quality Engineering (DEQE) regions of the coastal zone; in most cases information as to specific towns, project types and wetland types not available.

*indicates information by town available on attached sheets

Data requested	Northeast Region	Southeast Region	Total
Superseding determinations of applicability	6	1	7
Notices of Intent received by coastal commissions	135	1084	1219
Wetlands permits issued (Orders of Conditions)	104	902	1006
Determinations of non-significance* (Non-applicability)	20	285	305
Requests for superseding orders (Appeals)	16	88	104
Superseding orders issued*	12	67	79
Extensions issued	8	37	45
Adjudicatory hearings	1	1	2
Permits pending for court action	0	1	1
Hours spent per year in:			
preparing superseding orders	109.2	609.7	713.9
in adjudicatory hearings	12.5	12.5	25.0

Wetlands Protection Program

Data available by towns

Determinations of Non-applicability

Southeast Region:

Barnstable	41
Bourne	76
Brewster	22
Chatham	29
Dartmouth	30
Duxbury	11
Eastham	6
Edgartown	2
Fairhaven	3
Hanover	1
Marion	3
Nantucket	3
Norwell	3
Orleans	21
Provincetown	5
Rehoboth	8
Sandwich	5
Scituate	1
Seekonk	1
Taunton	3
Tisbury	1
Truro	2
Wellfleet	7
West Tisbury	1
Total	285

Northeast Region:

Beverly	3
Cohasset	2
Essex	4
Hingham	1
Hull	3
Ipswich	1
Newburyport	1
Quincy	4
Salisbury	1
Total	20

Wetlands Protection Program Northeast Region

Data available by towns

Superseding Orders issued

Barnstable	7
Bourne	1
Chatham	2
Dennis	2
Duxbury	1
Fairhaven	1
Falmouth	2
Gay Head	2
Harwich	4
Kingston	1
Marion	2
Marshfield	3
Mashpee	1
Nantucket	1
New Bedford	1
Oak Bluffs	1
Plymouth	2
Provincetown	2
Rehoboth	1
Sandwich	5
Swansea	1
Tisbury	1
Truro	3
Wareham	1
Wellfleet	3
Westport	3
Yarmouth	13
Total	67

Beverly	1
Braintree	1
Cohasset	3
Hull	3
Newburyport	1
Revere	1
Salem	1
Salisbury	1
Total	12

A response to the 1980 evaluation findings recommendation on the increased number of non-applicability determinations under the Wetlands Protection Act.

In recent years there has been a dramatic increase in the number of projects that local conservation commissions have been called on to review. There appear to be several factors involved in this increase, including:

- increased development in many towns mean that much work is being proposed in marginal areas.

- a greater understanding by project proponents of the jurisdiction of the Wetlands Act. This leads to more applicants coming to commissions of their own volition.

- the addition of very specific regulations for coastal areas in 1978 and the publication of the Guide to the Coastal Wetlands Regulations in early 1979 clarified for land owners and project proponents the sorts of projects that would be acceptable under the Act. Once the guidelines became better understood, many relatively minor projects were proposed.

- increased enforcement and monitoring capabilities in the form of staff brought more projects into the administrative system.

- in the past, minor projects were often judged in the field and overlooked if they were not immediately noted as significant. In several instances a further review caused such work to be halted and a Notice of Intent to be filed. To protect both sides and to bring these cases into the system, project proponents began to request documentation from the commissions prior to beginning work.

In the face of this increased load, many of the commissions began to use the Determination of Applicability/Non-applicability to make the "first cut" in the decision as to the significance of a project to the interests of the Act. This seems to be particularly true in the coastal areas which often have extensive wetlands and floodplains. Because any activity within 100 feet of either a wetland of 100 year floodplain could conceivably come under the jurisdiction of the Act, this could lead to a vast number of public hearings and administrative proceedings. By reviewing plans and deeming an obviously minor project as "not applicable", the Conservation Commission saves time and administrative resources by not requiring a public hearing. The applicant saves time, filing fees, costs of advertising the public hearing and often the costs of engineered plans. The requirement for documentation helps the commission protect the interests of the Act by allowing the project to be monitored - any violation can result in a Cease and Desist Order.

The increased use of the Determination of Applicability/Non-applicability therefore apparently is reflective of public awareness of the Wetlands Act and the ability of the commissions to administer it to realistically protect the interests of the Act.

RHODE ISLAND

Wetland Laws

In 1971 Rhode Island passed two separate laws protecting salt and freshwater wetlands as well as other areas:

1. Freshwater Wetland Act, (Rhode Island General Laws ss. 2-1-18-1-25. This law requires a permit from the Department of Environmental Management (DEM) in order to excavate, drain, fill, deposit materials or effluents upon, divert water flows into or out of, dike, dam, divert, change, add to or take from or otherwise alter any freshwater wetland, defined vegetatively; plus a 50 foot buffer area, together with surface waters and areas subject to flooding. However, the law exempts marshes under one acre in extent and swamps under three acres in extent. (Also ponds under 1/4 acre.) Values covered include flooding, wildlife, recreation, water levels and water supply. DEM has adopted regulations with further exemptions for emergency and maintenance work. This emergency and maintenance work applies only to "surface water impoundments used for drinking water supply", an exemption added in 1981.

Application is made to DEM for a preliminary determination as to whether or not the act applies: "The Wetlands Act shall be determined to apply if a significant alteration does appear to be contemplated..." This informal proceeding disposes of an overwhelming percentage of projects proposed. Reg. 4.03 defines insignificant alterations relating to wetlands work to include dug ponds of under 1/2 acre, cut and fill proposals involving riverbank wetlands where compensatory storage is provided, and drainage into wetlands where no known local flooding problems exist. Significant alteration is defined in Reg. 2.22 in terms of loss of wetland capability to moderate flooding, recharge ground water

supply, or provide wildlife habitat or recreational environment. Reg. 5.03, dealing with denial of applications, uses the same criteria, but adds reference to water quality, ability of wetlands to remove pollutants from surface water supply, degradation of "unique" wetlands, or reduction of value of "valuable" wetlands. Unique wetlands are defined in Reg. 7.06 to include presence of rare, endangered or unusual plants, uncommon geomorphological or archeological features, or outstanding wildlife diversity and production as determined by a revised version of the University of Massachusetts Models for Assessment of Freshwater Wetlands (WRRC Publication 32). University of Rhode Island Professor Frank Golet states that a study of the town of Richmond indicated that of 607 wetlands, only 36 (6%) scored as outstanding--but those 36 wetlands contained over half of all freshwater acreage. Over 36 percent of the wetland acreage scored high. The Reg. defines "valuable" wetlands as characterized by the University of Massachusetts model as "high" in diversity and production of wildlife; also, rivers and ponds classified as A, B, C_1 by DEM, Fish and Wildlife Division, or relatively natural wetlands capable of supporting recreation by the general public. (For details of Rhode Island's approach to wetland values, see Appendix A.)

Upon receiving a formal application, DEM sends notice to abutters and municipal officials. If the city or town council disapproves, DEM cannot grant the permit. A public hearing is held by DEM if there is an objection of a substantive nature. The decision is issued within 87 days from the mailing out of a notice, according to the statute. (However application guidelines indicate processing may take up to 6 months.) Appeal from disapproval by the municipality or the DEM is to superior

court; if the court determines the forbidden use was not harmful or unsuited to the land in its natural state, the landowner may elect to force the municipality or state to pay the fair market value of the wetland "based upon its value as a wetland".*

Amendments were proposed in 1981 and 1982 to bring state penalties in line with federal requirements for s. 404 program delegation. In both years, the Rhode Island legislature failed to act upon them.

2. Coastal Wetlands Management Act (Rhode Island General Laws ss. 46-23-6). RIGL ss. 46-23-1-17 created a Coastal Resources Management Council as the state's lead agency under the federal CZMA, including appointees of the legislature, governor and municipalities. The council's staff was established within what is now the state Department of Environmental Management, Division of Coastal Resources. A permit from the Council is required for any activity in a coastal wetland "and all directly associated contiguous areas which are necessary to preserve the integrity of such wetlands." Council Regulations 120.0-2-A interpret this jurisdictional area to include a minimum of 200 feet inland of the wetland. The 200 foot permit-application zone is not technically a buffer, though buffer areas may be established around wetlands within it on a case-by-case basis. Coastal wetlands are described as salt marshes, defined vegetatively. Reg. 120.0-2 further defines alterations to include depositing of fill or materials or effluent, excavation, ditching and dredging. Applicants must demonstrate by a "fair preponderance of evidence" that the coastal resources can support the activity and its

*The implication of this is that DEM must "pay a price" for valuing a wetland too high. (Editor)

effects, and that proposed work will not significantly damage biologic and/or hydrologic processes within or affecting the wetland. The Council may however permit such disturbance where clear and convincing evidence shows that a "bona fide benefit to the public welfare will result and that no reasonable alternative exists." Chapter 1, s. 4 of the Council's Coastal Resources Management Council Plan contains further criteria for decision, including "direct orientation to the coastal region" and consideration of cumulative long-term effects.

Under CRMC Reg. 120.0-2, a form of processing has been developed similar to the "preliminary determination" system under the freshwater law. Any person proposing to do work in the area covered by the law must request in writing a review by the Council to determine whether an application for a Council Assent (permit) is required. The majority of matters in the coastal area are dealt with through this informal procedure by which the Council sends out an "administrative assent" or a "letter of no objection" indicating the project is outside CRMC jurisdiction.

Applicants for a coastal permit must generally certify that they have obtained approval from all required municipal approvals such as zoning. Notice is sent to municipalities but not to abutters. If a formal objection and/or request for hearing is received by the Council within 30 days, a public hearing is held, generally after a prehearing conference and after notice is sent to abutters. Appeal is to the trial court, whose review is strictly limited. Generally the review of courts under state administrative procedure laws is limited to matters of law (such as the constitutional "taking" issue); the Rhode Island court in the Milardo case pointed out that in these reviews it will "reverse factual conclusions of administrative agencies only when they are totally devoid of competent evidentiary support in the record."

Because Rhode Island's CZM plan has been approved, federal projects in tidal wetlands would have to be deemed consistent with the policies.

Legal Decisions

The most important case decision on the freshwater wetlands act was J. M. Mills, Inc., v. Murphy, 351 A. 2d 661 (Rhode Island 1976) in which a landowner attacked the law as unconstitutional and as discriminatory in that it operated differently from the coastal wetlands law. The court upheld the act as a valid delegation of legislative power not in violation of state or federal constitutions. It also approved the distinction on grounds that the state might have a number of reasons for adopting different approaches, including greater development pressures on coastal wetlands, private ownership of freshwater wetlands, and the "probable interdependence and interrelation of coastal wetlands" necessitating "unitary state action". The Mills case was thus a direct attack on the law, not its application. Few such attacks succeed. It would, in fact, be amazing were a state court in this day and age not to approve of state wetlands protection laws in concept, so many states having already approved them. The legal difficulties arise when hardship or inequity is demonstrated in the application of a law to a particular plaintiff.

No applicant has ever sought compensation under the special freshwater wetlands act, that if a denial is held confiscatory, the court shall direct public purchase of the land at its wetland--rather than development--value.

Two other freshwater wetlands cases were decided after the Mills case: State v. Capuano, 384 A. 2d 610 (1978) and Citizens for Preservation of Waterman Lake v. Davis, 420 A. 2d 53 (1980). The latter was decided on procedural grounds (that only the state, not citizens or a municipality had standing to sue under the law). In State v. Capuano,

the Supreme Court reversed a trial court's determination that the statute wreaked a "taking" on developers who placed 30,000 cubic yards of fill in a Cranston Marsh without any permit.

The state Supreme Court recently decided its first case under the coastal act: Milardo v. Coastal Resources Management Council, 434 A. 2d 266 (September 1981). (Numerous cases have been decided in the trial courts under this law; the Council has always prevailed in all substantive challenges to its right to limit or forbid work in the subject area, according to Attorney Dennis Esposito, who has handled between 15 and 25 appeals since 1977.) The Milardo case concerned a septic system proposed to be built in an upland area adjoining a coastal saltmarsh. The Council, in denying the project because of possible pollution, was up against several serious problems which have caused reversals in other states: the plaintiff claimed he had been deprived of all practical use of his property; he had already obtained a health permit for the system; the system was adjacent to, but not in, the marsh itself; and the pollution from one such system might have been regarded as de minimis. Nevertheless the high court upheld the denial on several grounds: strong deference to the administrative decision of the Council; no legal property right to pollute, especially public areas; the possibility that a more effective sewage disposal system might be devised or that the land might have "other possible uses," and changing views of wetlands: "In particular, marshlands adjacent to coastal area and inland waterways are now recognized as vital to the economic and climatic well being of society." The fact that plaintiff needed in effect two permits for the same system was dismissed as resulting from the different purposes of health law and the coastal act. Although

"inverse condemnation" claims were not discussed, the case stands as a very strong defense of the Act.

Institutional

1. Freshwater wetlands. Rhode Island contains approximately 66,000 acres of freshwater wetlands subject to the law. According to Table 5 (adapted from data provided by the Department of Environmental Management Division of Land Resources report of May 1982, relative to delegation of the 404 program) DEM issued a total of 2,669 preliminary determinations from 1977 through 1981, with an average number of 534 annually. This corresponds roughly with the latest annual total (1981) of 509.

In the same five years, DEM has dealt with only 278 formal applications, although the percentage of such applications has been rising modestly, now standing at about 13 percent of the total. In the same period, the Department investigated 3,610 complaints, an average of 722 a year and determined that 611 of these were bona fide. Both violations and investigations of complaints have dropped off substantially since 1979 (probably because of the economic downturn). Information of possible violations is received from citizens, building officials, conservation officials, conservation commissions, conservation officers and state agencies. According to this report, site inspections are usually made by Wetlands Section field staff within a couple of days of receiving the complaint. Currently, 63 man-hours per week are devoted to field inspection.

A researcher studied all of the formal permits issued during 1980

Table 5. Freshwater wetlands permit actions by Rhode Island Freshwater Wetlands Section: 1977 - 81.

Actions	Year					Total
	1977	1978	1979	1980	1981	
Applications	440	531	693	707	576	2,947
Waived	406	498	625	631	509	2,669
Considered	34	33	68	76	67	278
Complaints	443	858	1,006	722	581	3,610
Violations Found	28	170	173	150	90	611

and 1981 in order to find out the relevance of these data to protection of wetlands in Rhode Island. The results are summarized on Table 6. Ninety-three of the 143 major formal applications filed during the two-year period were confirmed as relating to vegetated wetlands (66%). (This percentage may be low because, of the 23 files not available for study and biologist's reports indicated that vegetated wetlands might be included among these.)

This percentage, about two thirds of all formal applications, is much higher than the percentage of cases reviewed under the Wetlands Protection Act in Massachusetts, for wetlands that are classified as vegetated. This is because the Rhode Island statute requires formal review of all projects involving vegetated wetlands. Since over 85 percent of all applications are dealt with informally, minor floodplain projects, which play a large part in the Massachusetts local/state procedures, do not get as far as the formal permit procedure in Rhode Island.

Unfortunately, it was not possible from the files to determine the size of most wetland changes contemplated in these permits. Also, the cumulative effect of numerous nonformal projects held to be insignificant (e.g., numerous dug ponds in wetlands) was not reflected in the data.

Well over half of the applications were for residential use, including private driveways. Private waterways was the next most frequently-occurring category, suggesting that residential uses comprised an average of about 60 percent of the formal permits over the two years. However, according to DEM Wetlands Supervisor, Todd Bryan, highway and industrial applications may involve more actual wetland acreage.

Table 6. Classification of Inland Wetlands Permits Considered by the Rhode Island FWWS in 1980 and 1981**.

Type of Project	1980 No.	1980 Percent	1981 No.	1981 Percent	Total No.	Total Percent
Residential***	25	48.1	21	51.2	46	49.5
Commercial	1	1.9	4	9.8	5	5.4
Industrial	3	5.8	5	12.2	8	8.6
Recreational	4	7.7	4	9.8	8	8.6
P.W. (drainage, water supply)	4	7.7	4	9.8	8	8.6
Road	14	26.9	3	7.3	17	18.3
Agriculture	1	1.9	0	0.0	1	1.1
TOTAL	52	100.0	41	100.1*	93	100.1*

*Total greater than 100% because of rounding.

**Total permits considered by FWWS in 1980 and 1981 was greater than 52 and 41 respectively, but the files on some permits were not in the master file when it was analyzed for this project.

***Includes both single family lots and subdivisions, the latter most frequent. Also, approximately 2/3s of projects classified as "roads" were access roads for residential projects. If road projects were allocated by purpose, "residential" would be well over 50% in both years.

The number of formal permit applications dropped during the period from 76 in 1980 to 67 in 1981 (Table 5), and the number of wetlands-involved applications dropped even more sharply from 52 to 41 (Table 6). The number of permits denied rose both proportionately and absolutely from 13 in 1980 to 15 in 1981--the latter number being 36 percent of all formal permits applied for. This figure too is extraordinarily high compared with denials in other states, perhaps again because minor projects are weeded out in the informal procedures.

The researcher, Geoffrey Rogers, pointed out that many of the applications date back a number of years because applicants frequently failed to supply information early enough, or attempts were made to change the project.

An analysis of the thirteen 1980 denials showed that 6 of the 13 were made by the affected community, 7 by DEM. Only two 1980 projects were ranked as major. All but two of the 1980 denials appear to be residential. Of the two nonresidential, one was an airport road, the other, excavation of gravel to create a 70,000 square/foot pond. These were also the only two denials designated "major". The pond project was subsequently approved in 1981 after public water supplies were exempted from the law.

An analysis of the fifteen 1981 denials indicates a very different picture. Five of the projects were considered "major", including proposed fill in vegetated wetlands for two subdivisions, a church, athletic fields, and an industrial highway. One of the subdivisions was referred to the Corps of Engineers. All but two of the denials were issued by DEM rather than the local community. Overall, 3 denials involved

nonresidental roads, and only 4 clearly involved residential uses (although some are unclear). Either the proposals are becoming more diverse and "outrageous" or the DEM is definitely cracking down. (Of course two years is by no means a statistically reliable sample on which to base firm conclusions.)

2. Coastal wetlands. Rhode Island has 419 miles of coastline containing approximately 3,668 acres of tidal marsh (CRC/RI 1976 Coastal Atlas); this low figure reflects prior development of many marsh areas. According to the Department of Environmental Management, Coastal Resources Division's CZM reports, the total of formal and informal permits processed in 1981 and 1980 were:

	1981	1980
Assents (Permits)	149	170
Denials	16	10
Letters of no objection (informal permits)	275	124
TOTAL	440	304

A December 1981 CZM report indicates that increased staff investigations have increased the number of requests to the Council for a determination as to whether a formal permit is needed. This, in turn, has increased the number of letters of no objection and decreased the number of public hearings which must be held after valid objection to a Council decision. However, the number of violations is said to be holding steady. Single-family dwellings with sewage disposal systems (the report states) have dominated the general coastal caseload since 1978 (35 or 38%); prior to 1978, emphasis was on installation of piers,

docks, floats, and shoreline protection facilities. However, there has been a substantial increase in applications for residential and commercial piers, docks, floats, and for dredging in 1981 (altogether, 41%).

The state's CZM reports are frank to state they are not sure how their coastal caseload relates to coastal wetlands. The Division's July 31, 1981 report states (p. 4) that there is no precise datum for wetlands and estuaries damaged and/or restored. The Division then reported 3 cases before it, only one involving over 1/8th acre, and complained of the "continuing nickel and dime" violations throughout the region involving filling and alteration of marshes, often associated with local sewer installation projects and other projects apparently favored by local communities. The December 1981 report lists 14 cease and desist orders for "fill on/in marsh", and 9 orders to remove/restore, plus one 1981 court action for fill in a marsh.

Rogers studied all the formal applications made to CRMC in 1981 for work in marshes up to 200 feet inland (the area of jurisdiction under the regulations). (See Tables 7 and 8.) Of 54 applications, 35 were for work within the jurisdictional area, but not within a vegetated wetland. While the CZM Report indicates 15 denials during this period, Rogers reviewed only 8 of these.

Each permit carries numerous conditions from the Council relating to erosion control measures, protection of the area against sedimentation, revegetation requirements, and often a requirement to create a new wetland to replace those filled in. As with the general permit load for the Coastal Council (and, indeed, as with the freshwater permits), residential and recreational applications dominated. Work approved in marshes

Table 7. Classification of Coastal Wetlands Permits Considered by the Rhode Island CRMC in 1980.

Type of Project	Number	Percent
Residential	37	68.5
Recreational	4	7.4
Institutional (Dormitory)	1	1.9
Public works	6	11.1
Seawall construction	6	11.1
TOTAL	54	100.0

Table 8. Principal** Wetlands Actions Proposed and Disposition of Coastal Permits Considered by the Rhode Island CRMC in 1980.

Principal Actions Proposed	Applications		Approved		Number Denied
	Number	Percent	Number	Avg. No. Conditions	
Residential					
Fill and/or excav.	21	38.9	17	8.9	4
Drain	4	7.4	4	14.5	0
Construct.	13	24.1	12	6.4	1
Municipal Public Works					
Fill	3	5.6	3	19.5	0
Drain	3	5.6	3	6.3	0
Sea Wall Const.	5	9.3	4	12.2	1
Recreation excav. and fill	4	7.4	3	5.3	1
Fill not specified	1	1.9	0	-	1
TOTAL	54	100.2*	46	9.3	8

*Total greater than 100% because of rounding.
**"Principal" ascertained judgmentally. Other actions almost always part of project.

included seawalls, drainage, boat ramps, and sewer lines. No acreage was available except for two of the projects; in most cases, according to the Council, the area was quite small. The Council states that it has not approved any major coastal wetland fill. The number of denials for work in wetlands does not conform well to that contained in CZM reports (see Table 8) unless all 15 denials reported by CZM related to wetland fill cases.

COE Activity in Rhode Island

Clearly the Corps' activity in Rhode Island has been focused on the coastal area. Corps' records do not clearly distinguish coastal from freshwater permits. However, from the type of project involved, one can deduce that in 1981, the COE handled 62 permit applications, principally for piers, docks, boat ramps, retaining walls, dredging, bridge work. Disposition of these cases is indicated in Table 9.

COE reports (letter to FWS dated 16 July 1982) that there is no need for application, nor any reporting procedures for activities authorized under nationwide permits; hence there may be 404 activities going on that fall into this category of which COE is unaware. COE also reports that no penalties have been imposed on 404 violators in Rhode Island as of 16 July. (Nor is information kept as to complaints or inquiries.)

According to the Rhode Island FWWS 1982 report on Rhode Island, assumption of 404 responsibilities and COE data, only one of the 40 individual permits involved an area subject to the freshwater law. (Prior figures were: 1 in 1980; 2 in 1979; 5 in 1978; and 4 in 1977; no regional general permits were requested or issued in 1977-1981). Since COE jurisdiction also covers open water and banks, even this single permit may not

Table 9. Corps of Engineers activity level in Rhode Island relative to 404 responsibilities, 1981.

Action	Number	Percent
Approved	52	83.9
Determined Exempt	(2)	(3.2)
Nationwide Permits*	(3)	(4.8)
Regional Permits	(7)	(11.3)
Individual Permits	(40)	(64.5)
Denied	1	1.6
Withdrawn	9	14.5
Total	62	100.0

* In New England as a whole, the Corps issues many more "nationwide permits" than it does any other type. In fact, designation of eligibility for a nationwide permit is the Corps' principal means for "weeding out" what it considers inconsequential actions. Therefore, the specification of only 3 such permits among 62 considered in Rhode Island in 1981 is a highly suspect statistic. It is possible that only these 3 "made it" through early preliminary determination considerations.

have involved wetlands. Of the 39 COE permits, it is likely that few if any involved work in coastal wetlands; the researcher's investigation of 1981 COE coastal files involving wetlands fill (see COE Section, this report) revealed no Rhode Island cases.

Some Examples Involving Major Wetlands Work

1. Smithfield-Peat Co. (Freshwater)

Company ditched 19A red maple swamp before law went into effect (1971). Company dug out peat, replaced with gravel. After law went into effect, court ordered company to apply for state permit. Permit granted because "swamp could not be saved." Inquiries regarding this project at COE office in Waltham did not yield any evidence of Corps involvement.

2. W. Warwick Industrial Park (Freshwater)

Owner wanted to fill 20A; state denied; case now going to public hearing. Wetland evaluated as "high" under University of Massachusetts Model. COE not involved yet.

3. I-895

Originally planned as interstate, now reduced in scope; still involves "high" and "outstanding" value wetlands in planning process; COE involved.

4. P & WRR Fill (Coastal)

Up to 50A fill/bulwarking in oil farm area of Providence Harbor, along Providence River. No natural wetlands. State gave permit because work in developed harbor consistent with coastal plan.

5. General Dynamics-Electric Boat (Coastal)

650,000 ft. of paving proposed in Narraganset Bay. Still before CRMC.

RHODE ISLAND APPENDIX

RHODE ISLAND APPENDIX

WETLANDS WILDLIFE EVALUATION MODEL AS USED BY R. I. FRESHWATER WETLANDS SECTION

(From Carolyn Weymouth, Rhode Island Dept. of Environmental Management, Division of Land Resources. Designated "Draft only")

The Rhode Island Department of Environmental Management's Fresh Water Wetlands Section (FWWS) evaluates wetlands as wildlife habitat using a modification of the 1973 "Wildlife Wetland Evaluation Model" of Dr. Francis Golet presented in the 1976 publication, "Models for Assessment of Freshwater Wetlands." Golets system which incorporates a wetland classification based on life forms and subforms of vegetation, provides a method of expressing a wetland's wildlife value in quantitative terms. A number of criteria which contribute to a wetland's value as a wildlife habitat are identified. The wetland to be evaluated is rated numerically (ranked) for each criterion. Each rank is multiplied by a significance coefficient which reflects the relative importance of each criterion to the overall wetland value. The sum of the scores (rank X significancecoefficient) which a wetland achieves is its wildlife value. The numerical wildlife value scores of wetlands can then be compared. Ranges of values have been established which are used to categorize wetlands as of either "low," "medium," "high," or "outstanding"value to wildlife.

Attached are work sheets and copies of the original and the modified Golet evaluation system. The following discussion presents the difference between the original Golet system and the evaluation procedure currently employed by the FWWS.

Since publishing the original wetlands wildlife evaluation model, its author has made a number of modifications. The number of criteria upon which

the wetland is ranked was reduced from ten (10) to nine (9) by dropping the "Water Chemistry" category. The specification of depth of the "open water" (OW) class from 3' to 10' was deleted. "Open Water" now includes water of any depth. The class "seasonally flooded flats" (SF) was dropped as these areas fit into other classes such as shallow marsh, or were found to be open water or upland.

The class "Bog" originally included both peatland poor in minerals and having rainfall as the source of water (ombrotrophic) and peatlands rich in minerals fed by groundwater (rheotrophic). Golet subsequently separated the latter, rheotrophic wetlands, into another class called "Fen" (f). The ombrotrophic wetlands remained in the class "Bog" (B).

Along with the changes in the composition of the classes, there were changes in the ranking of the dominant wetland class. These changes are elaborated in the attached outline of the modified system (Table 2).

Finally, the importance of the contribution of "cover type" and of "vegetative interspersion type" to the final wetland score was reduced and that of "wetland juxtaposition" increased. This was accomplished by changing the significance coefficients of "cover type" and "vegetative interspersion type", each formerly three (3) to two (2). The significance coefficient of "wetland juxtaposition" was raised from two (2) to three (3).

As a result of these changes the lowest score which can be obtained through application of the system is 35, rather than 36. The highest score possible is 105, 3 points lower than the 108 possible before modification.

To adopt the Golet system, which was designed for use throughout the glaciated northeast, to local conditions in Rhode Island it was necessary for the Fresh Water Wetlands Section to make several changes in size criteria. As most wetlands in the state are relatively small, the minimum area necessary to type a class was reduced from five acres to two and a half (2.5) acres and for typing subclasses, from one acre to one-half acre. The "size category" criterion was adapted by halving the acreage required for each range. This adjustment is also reflected in the "wetland juxtaposition" scoring where a wetland with three or more wetland classes including marsh must be greater than 250 acres rather than 500 acres to achieve the highest rank.

The FWWS uses the following ranges of scores as an index of the wetland's value as a diverse and productive wildlife habitat:

low:	35.0 - 50.0
medium:	30.5 - 60.0
high:	60.5 - 70.0
outstanding:	70.5 - 105

A wetland may be determined to be "unique" if it achieves a score of 70.5 or above using the wetland wildlife evaluation system described above or if it is of special ecological or cultural significance within Rhode Island and possesses one or more of the characteristics listed below.

1) presence of rare or endangered plants or animals
2) presence of plants of unusually high visual quality and infrequent occurrence
3) presence of plants or animals at or near the limits of their geographic range
4) unusually high production of native waterfowl
5) annual use by great numbers of migrating waterfowl, marsh birds or wading birds

6) "outstanding" wildlife diversity and production as determined by the aforementioned "Wetland-Wildlife Evaluation Model"

7) presence of outstanding or uncommon geomorphological features

8) presence of outstanding archaeological evidence

9) availability of reliable scientific information concerning the geological, biological or archaeological history of the wetland

10) designation as rare, endangered, exemplary or unique by the Rhode Island Natural Heritage Program.

This list differs from that presented in "Models for Evaluation of Freshwater Wetlands" (Larson, 1976) in the following respects:

1) exclusion of "the juxtaposition, in sequence, of several seral stages of hydrarch succession" as a unique characteristic

2) addition of numbers six and ten to the list

3) deletion of "wetlands that are relatively scarce in a given physiographic region or that provide distinct visual contrast" as these areas are encompassed by numbers six and ten.

TABLE R1.
GOLET'S WETLANDS EVALUATION SYSTEM (1973)
Wildlife resource variables, significance coefficients, specifications and ranks.

	SPECIFICATIONS[1]				
RANK	(3.0)	(2.5)	(2.0)	(1.5)	(1.0)
RESOURCE VARIABLES					
Wetland Class Richness (5)[2]	5 or more classes	4 classes	3 classes	2 classes	1 class
Dominant Wetland Class (5)	SF, DM	SM	WC, SS	OW, BG	M
Size Category (5)	over 500 acres	101-500 acres	51-100 acres	10-50 acres	under 10 acres
Subclass Richness (4)	10 or more subclasses	6-9 subclasses	4-5 subclasses	2-3 subclasses	1 subclass
Site Type (4)	bottomland-lakeside bottomland-deltaic bottomland-streamside		bottomland-isolated upland lakeside		upland-isolated

[1] See PART I for definition of terms.

[2] Number in parentheses after each resource variable is its significance coefficient.

Table R1. (continued)

SPECIFICATIONS

RANK	(3.0)	(2.5)	(2.0)	(1.5)	(1.0)
RESOURCE VARIABLES					
Surrounding Habitat Types(4)	2 or more of following constitute more than 90% of surrounding habitat: 1. forestland 2. agricultural or open land 3. salt marsh		1 or more of following constitute 50-90% of surrounding habitat: 1. forestland 2. agricultural or open land 3. salt marsh (or) 1 of preceding constitutes more than 90% of surrounding habitat.		1 or more of following constitute less than 50% of surrounding habitat: 1. forestland 2. agricultural or open land 3. salt marsh
Cover Type (3)	Type 5	Type 4	Type 3 Type 7	Type 1 Type 2 Type 6	Type 8
Vegetative Interspersion Type (3)	Type 3		Type 2		Type 1

Table R2. Outline of the modified Golet (1973) evaluation system for freshwater wetlands.

RANK	(3.0)	(2.5)	(2.0)	(1.5)	(1.0)
Criteria			Specifications		
+Wetland Class Richness (5)[a]	5 or more classes	4 classes	3 classes	2 classes	1 class
Dominant Wetland Class (5)	DM,SM*	WS*	SS,F*,BG*	OW	M
#Size Category (5) (acres)	over 250	51-250	26-50	5-25	under 5
%Subclass Richness (4)	10 or more subclasses	6-9 subclasses	4-5 subclasses	2-3 subclasses	1 subclasses
Site Type (4)	bottomland-lakeside bottomland-deltaic bottomland-streamside		bottomland isolated upland-lakeside		upland-isolated

+ # % Refers to modification of original system by D.E.M. Wetland Staff
[a] Number in parentheses after each criterion is its significance coefficient.

* Refers to modification of original system (Golet).
\+ 2.5 acres or more per class
% .5 acres or more per subclass

Rank			1980
	low:	35.0-50.0	29%
	med:	50.5-60.0	43%
	high:	60.5-70.0	17%
	outstanding:	70.5-105	11

Table R2. (continued)

RANK	(3.0)	(2.5)	(2.0)	(1.5)	(1.0)
Criteria			Specifications		
Surrounding Habitat Types (4)	2 or more of following constitute more than 90% of surrounding habitat: 1. forestland 2. agricultural or open land 3. salt marsh		1 or more of following constitute 50%-90% of surrounding habitat: 1. forestland 2. agricultural or open land 3. salt marsh (or) 1 of preceding constitutes more than 90% of surrounding habitat.		1 or more of following constitute less than 50% of surrounding habitat: 1. forestland 2. agricultural or open land 3. salt marsh
Cover Type (2)*	Type 5	Type 4	Type 3 Type 7	Type 1 Type 2 Type 6	Type 8
Vegetative Interspersion Type (2)*	Type 3		Type 2		Type 1

Table B2 (continued)

	(3.0)	(2.5)	(2.0)	(1.5)	(1.0)
Criteria			Specifications		
'etland Juxta-position (3)*	Hydrologically connected to other wetlands (different dom. class)or open water bodies within 1 mile, (or) Hydrologically connected to other wetlands (same dom. class) within 1/4 mile, (or) Wetland greater than 250 acres, with three or more wetland classes (including DM or SM).		Hydrologically connected to other wetlands (different dom. class) or open water bodies from 1-3 miles away, (or) Hydrologically connected to other wetlands (same dom. class) from 1/4-1 mile away, (or) Within 1/2 mile of other wetlands (different dom. class) or open water bodies, but not hydrologically connected.		All other possibilities

CONNECTICUT

Wetland Laws

The Connecticut system is very complex; 4 major laws encompassing all kinds of wetlands.

1. Tidal Wetlands (Conn. Gen. Stats. ss. 22a-28-35). The first wetlands law, passed in 1969, established a state-permit program for "regulated activities" in wetlands defined vegetatively as including areas lying beneath tidal waters or bordering them with surfaces up to one foot above local extreme high water. Regulated activities include all kinds of dredging and filling, erection of structures, excluding public health emergencies and state mosquito control activities, conservation activities, and all authorized "aids to navigation." The state Commissioner of Environmental Protection mapped these areas and has adopted Regulations pursuant to the law.

Values protected are public health and welfare, marine fisheries, navigation, aesthetics, recreation, shellfisheries, wildlife, prevention of flooding, erosion, and sedimentation. Permit applications are made to DEP and sent to the affected town, adjacent landowners, and COE. A hearing is held unless the Commissioner decides activity is "not likely to have a signficant impact." Permit conditioning or denial is permitted. A bond may be required. Regulations do not contain criteria for "significance" relative to public hearings; but they do contain lengthy criteria for review relating to each protected interest; guidelines on compatible and incompatible uses, and a general requirement that wetlands not be destroyed unless "there is no alternative for accomplishing the applicant's objec-

tives which is technically feasible and would further minimize adverse impacts."

2. Inland Wetlands and Watercourses: (Gen. Stats. ss. 22a-36-45). Originally passed in 1972, this law requires permits for "regulated activities" in land watercourses (including vernal and intermittent brooks) and wetlands defined in terms of poorly drained, very poorly drained, alluvial, and flood-plain soils. This definition includes approximately 20-25% of the state and includes many areas not defined as wetlands by COE under s. 404. No other New England state defines wetlands by soils.

Values covered include pollution, water quality, erosion, turbidity, siltation, fish and other beneficial aquatic organisms, wildlife, vegetation, natural habitats, flooding, aesthetics, recreation and water supply. Regulated activity means any operation or use of a wetland or watercourse involving removal, deposition of material, obstruction, construction, alteration or pollution. Exemptions include grazing, farming, farm ponds under 3 acres, boat moorings, water company of municipal drinking water supply facilities, nondisturbing recreational activities and "uses incidental for the enjoyment and maintenance of residential property", not involving significant removal or deposition in the wetland or watercourse.

The state Department of Environmental Protection (DEP) administers the law as to state projects and as to all activities in 15 communities which have not chosen to pass their own municipal regulations (including several sizable cities such as New Haven). Thus 154 communities run their own independent regulatory programs under the law. The state has its own Regulations (largely procedural) with which local Regulations must be "in

conformity", and sends out Guidelines to the muncipalities; but local regulations may be much stiffer as to area covered (buffers), activities requiring hearings, etc. State guidelines suggest public hearings with notice for significant activities defined as those involving more than 100 cubic yards of fill within a wetland. Appeal of local, as state, decision is to court.

3. Stream Encroachment Law (Gen. Stats. ss. 25-4A-4G). Since 1973 the Commissioner of DEP has had authority to establish lines along tidal or inland waterways or floodprone areas under consideration for flood alleviation, beyond which no obstruction can be placed without a permit from DEP. Although directed towards flood/storm control, the law also covers ground and surface water, animal and plant life, and nutrient exchange.

To date only 366 miles of streambank have been mapped, largely because of the cost of mapping. DEP believes perhaps ten times as many should be regulated. DEP has no estimate of the amount of wetlands involved. Approximately 20 permit applications are processed every year, often in combination with permits under other laws.

4. Coastal Management Act (Gen. Stats. ss. 22a90-112). Passed in 1978 in order to gain approval under the CZM Act, this law supplements the tidal and inland laws in 41 coastal communities within a mapped area about 1000 feet back from tidal wetlands. The law expressly allows joint processing with COE and DEP/COE discussions on CZM "federal consistency" questions. However, the communities are supposed to process the law themselves through appropriate zoning revisions (the law does not supercede local zoning) and through site plan reviews for all major projects in the

coastal area. The major likely effect of the law on coastal wetlands is to relieve destructive pressures and indirect adverse impacts on areas already covered by the tidal wetlands act. The law also aims to guarantee that state projects will be consistent with its policies; and the CZM Act requires federal consistency with approved plans. The many policies include preservation and restoration of tidal wetlands.

In addition to the four state laws, a number of communities have floodplain or wetlands protective local laws, some dating from the decade before state action.

Legal Decisions

The Connecticut Supreme Court originally took a conservative view of wetlands regulations where a landowner's values were significantly reduced. In Bartlett v. Zoning Commission, 161 Conn. 24, 282 A 2d 907 (1971), it struck down an Old Lyme tidal ordinance limiting land use for noneconomic conservation uses and it also invalidated a Fairfield floodplain district permitting few uses in Dooley v. Town Planning & Zone Commission, 151 Conn. 304, 197 A 2d 770 (1964). Although the constitutional test is still whether the economic utilization of the private land is, for all practical purposes, destroyed (Prof. Terry J. Tondro, Conn. Land Use Regulation, University of Connecticut School of Law Press, 1979, p.7) the court has recently shown a greater disposition to avoid this conclusion. In Brecciaroli v. Commissioner of Environmental Protection, 168 Conn. 349, 362 A 2d 948 (1975), the court upheld denial of a permit to fill five acres of tidal wetland for industrial use, holding that denial of one specific use did not foreclose possible other uses. The 21 acre parcel contained

17.5 acres of tidal wetlands. How far this "try, try again" approach would have to go was not specified. An important 275 acre saltmarsh is at issue in a case (formerly Ryker, now SLIC) which has had a decade of state hearings and denials and is scheduled to be tried on the "taking" issue. The landowner wants to fillthe marsh for industrial purposes.

A key case under the inland wetlands act was decided in April of 1981. In Aaron v. Conservation Commission, Town of Redding, _____, Conn. ____, _____ A 2d _____ (Sept. 1981)* the court upheld denial of a septic system application to install a domestic septic system within 50 feet from a wetland and 150 feet from a watercourse, in the face of a strong argument that the town's regulations exceeded the state law and regulations which made no reference to "setbacks" around wetlands. The court ruled that a new septic system was not a "use incidental to enjoyment of residential property."

A number of factors may have contributed to the apparent change of direction, including a change from scattered local protective laws to the numerous state laws discussed above, and the state's strong conservative stance that a court should not reserve an administrative decision; Manor Dev. Corp. v. Cmmn. of Town of Simsbury, 433 A. 2d 999, 180 Conn. 692 (1980) (loss of some lots not confiscatory); East Haven Ec. Dev. Comm. v. DEP, 36 Conn. Sup. 1, 409 A. 2d 158 cert denied 403 A. 2d 1101, 178 Conn. 755 (Commr. need not detail all factors he considers). See also Vartelas v. Water Resources Commission, 146 Conn. 650, 153 A. 2d 822 (1959) (early stream encroachment case).

A lower court case seems to rule that localities may not regulate

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*This case has not yet been entered for reference in the citation literature.

tidal wetlands more stringently than the state (Lauricella v. Planning and Zoning Board of Appeals, Town of Greenwich, 32 Conn. Sup. 104, 343 A. 2d 374 (1974); but the result may have been changed by municipal powers granted under the Coastal Management Act.

Institutional

1. Tidal Wetlands.

David Manke of the Water Resources Unit, DEP, reports that only a few permit applications are received annually involving proposed fill in tidal wetlands. Most of these are modified or denied. For example, in 1979, DEP received 26 permit applications. Four were withdrawn; 6 involved no permanent fill. Three residential uses filled 2,500 square-feet, 2 marinas filled 16,000 square-feet, and a sewer pumping station filled 2,000 square-feet: a total of a half acre of fill. In 1980, after the Coastal Area Management program began, permit applications dropped to 20. Eight were withdrawn, 2 were denied. Of the 10 granted, 4 were for docks and wharves, 2 for dredge-disposal pipe crossing, 2 for riprap, 1 for residential and 1 for a maricultural pond. Wetlands fill was minimal.

Haynes Johnson, environmental attorney, reports that though coastal permits are few (and mostly involve low wetland acreage), some are important. For example, many acres were filled in Hamanasett state park; 340 acres are at stake in the SLIC proposal.

2. Freshwater Wetlands.

Douglas Cooper, Chief of the inland wetlands program of the Water Resources Unit, reports that due to the unique way in which the inland law is structured (see legal section), the state DEP has very little information on how the overall permit program works. (An intern will begin a study during the summer of 1982.) His office is supposed to receive copies of all permits granted by local boards but he is aware the information is incomplete. He does have a file of appeals to the courts. He believes

that the communities display great variety in their ability or interest in enforcing and administering the law. He thinks there are few large violations, but a lot of small illegal fills (the "foot a month club"). He speculates that there may be a decrease in applications to fill inland wetlands because of permit hassles. (Note, however, that research in Massachusetts shows that although amount of fill in large areas may have decreased, number of applications has not.)

COE Activity in Connecticut

Douglas Cooper reports he has little contact with the COE since most permits are handled locally. The coastal program on the other hand is in close contact with COE and David Manke attends every monthly COE joint processing meeting. He reports his Water Resources Unit values the COE backup in large permit situations.

The COE has been quite active in the Connecticut coastal area. In FY 1980 there were 90 Sec. 10/404 permits issued, presumably all coastal but not necessarily all work in wetlands. This compares with 21 Sec. 404 permits in inland areas, but again, this figure is not restricted to vegetated wetlands. In light of the number of state permits granted in each area, it seems clear that the COE is fairly comprehensive in its coastal activities and is less effective inland. A Connecticut coastal case (see below) appears to be the only COE (New England Division) denial not mirroring state or local denial.

The COE and Connecticut currently have a joint public notice and are considering instituting joint public hearings.

Some Examples Involving Major Wetlands Work

1. Coastal

Tosto, Essex, Connecticut, December 1981; proposed deposit of fill in a backyard; denied by COE.

SLIC (see text) proposed to fill 375 acres of coastal marsh; lengthy state proceeding; matter due to come to trial. COE involvement unknown.

Milford, Peck, fill for 6 houses; COE denied permit to fill about 4 acres of wetlands though approved by town.

2. Freshwater

Fill in wetlands along the Quinnipiac River, North Haven, at least 4 companies; mostly allowed by local permit. No COE involvement known.

New Haven, access to airport involving 7,000 square feet coastal wetlands; still in process.

Marlboro, MacLean Trucking, residential cut and fill to create pond and upland in 25-30 acres swamp on tributary of Salmon River (fish restoration area); disposition unknown.

Manchester landfill expansion along Hockanum River; received local permit and state permit (stream encroachment law), five acres wetlands; The Corps granted a permit with mitigation measures so there will be no net loss of wetlands.*

Plainville landfill expansion; local permit and 404 permit issued, wetlands acreage unknown.

Windsor, town way (River Road) on Farmington River relocated because of flooding; local permit granted, approximately 1 acre wetland filled.

North Haven Mall has generated considerable controversy for a number

of years. The site includes about 35 acres of wetlands and gravel ponds. Flooding in the area has been cited as a problem. The Corps is currently preparing an EIS, and recently held an overwhelmingly well-attended public hearing.

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*Regulation of landfills is controversial: The Corps seeing them as EPA's responsibility, EPA, the Corps'. We have no further information on either the Manchester case or the following Plainville case. The Corps may issue permits for dikes or floors associated with landfill operations.

NEW HAMPSHIRE

Wetland Laws

New Hampshire regulates coastal and inland wetlands under a single state law requiring a permit from the state Wetlands Board (NH Rev. State. Ann. ch. 483-A, ss. 1-7). The law was passed in 1967; until 1969 it applied only to tidal wetlands. The law defines tidal wetlands in terms of vegetation upon areas whose surface is not more than 3.5 feet above local mean high tide; it defines fresh water wetlands as swamps or bogs subject to periodic flooding by fresh water. The law also applies to inland surface waters. Regulated activities are excavation, removal, filling, dredging or constructing structures. Values covered include finfish, shellfish, wildlife, plants, recreation, aesthetic enjoyment, ground water levels, flooding, siltation and the "interests of the general public" (water supply not mentioned).

Application for a permit is made to a state Wetlands Board consisting of state officials and public appointees, with a state engineer to staff it. The board has established Regulations which further define freshwater wetlands vegetatively and distinguish "major" from "minor" projects, the latter not requiring a public hearing. Major projects include work in any saltwater wetlands or in a half acre or more of freshwater wetland, or work in more than 20 percent of any freshwater wetland; subdivision of over 3 lots; and certain related projects taking place over 5 years. The municipality where the proposed action will take place is given a chance to comment. Approximately 70 percent of municipalities have conservation commissions which review applications. Under s. 7, a municipality may

map "prime" wetlands; thereafter the Board will not grant a permit for activities in such a wetland without a written finding that the activity will not impair any of the statutory values; also the municipality may appeal a Board decision on such a mapped wetland. All appeals are to Superior Court. No exemptions (except minor maintenance) are stated in the statute or Regs, but the Regs do contain extensive criteria for major, minor and "mirimum impact" (super minor) projects (e.g., up to 3,000 square feet of fill in inland freshwater wetlands) on which no field inspection is held.

Legal Decisions

The principal case decision under the New Hampshire law is the leading case of Sibson v. State, 115 NH 124, 336 A. 2d 239 (1972). This case, culminating a series of three suits between the Sibsons and the State involved the landowners' efforts to fill 2 of their 6 acres of coastal marsh, 2 already having been filled before the 1969 amendment. The court upheld denial of the permit on the basis of the reasoning of the famous Wisconsin case of Just v. Marinette Co., 56 Wisc. 2d 7, NW 2d 761 (1972), implying that landowners do not have the right to change the natural condition of the land in such a way as to injure the public interest. Burrows v. Keene, 432 A. 2d 15 (1981), a nonwetland case, may have limited this Sibson decision, since the court distinguished it by referring to the "unique" value of salt marshes. It seems most likely, however, that the New Hampshire court will settle into the more usual middle position--that regardless of the economic impact on the landowners, destruction of wetlands can be forbidden if a public hazard is shown to

exist or if the wetland is shown to be exceptionally valuable. In a 1975 case, the court adopted the conservative position on administrative review: that the Wetlands Board's decision, whichever way it goes, is reversable only if unlawful, unreasonable or unjust, Town of Hampton v. Special Board of New Hampshire 116 NH 644, 365 A 2d 741 (1976), upholding board's denial of town's proposal to fill 3/4 of an acre of saltmarsh which was a highly productive source of carbon. The purpose was to reach a sewer line and enlarge a parking lot. Note that in this context, the taking issue--overregulation of private property--did not arise. Also the court found that the fill was unnecessary for the stated purposes.

Institutional

New Hampshire has approximately 6,600 acres of undeveloped tidal wetlands in about 17 miles of coastline. The state CZM plan, just approved, will network existing state laws. In the last two years 70 permits along the coast have been approved, principally reconstruction of areas damaged by the 1978 storm. According to Robert E. Chamberlin, state Wetlands Bd. Engineer, no fill has been approved in unaltered (not previously filled) coastal wetlands in 8 years. Mainly because of the impact of the Sibson decision, few applications are made.

Most Wetlands Board applications (see attached table) relate to work in freshwater wetlands, whose total extent is unknown. Most are for projects considered minor and are approved without hearings.

Wetland Board reports from April 1970 through September 1981, summarized on attached table, show a total of 10,360 approvals, 519 public hearings (indicating major projects, which average 50 a year), 4,685 field

Table 10. New Hampshire State Wetlands Board Actions, 1970-81.

Dates	Permits Approved	Permits Denied	Percent Denied	Inspections	Cease & Desist	Atty. Gen'l	Govt. & Council
4/70-6/76	4,957	245	4.9	2,134	354	114	40
FY76	1,571	55	3.5	900	93	19	25
FY77	1,099	62	5.7	500	107	21	18
FY78	759	60	7.9	643	140	17	10
FY79	778	36	4.6	NA	100	17	4
FY80	860	43	5.0	400	23	8	0
7/81-9/81	336	30	8.9	108	38	9	1
TOTAL	10,360	531	5.1	4,685	855	205	98

inspections, and 531 denials. These figures are far lower than the estimate of 1,000-2,000 annual permits by Wetlands Board Chairman Delbert Browning to OTA by letter June 11, 1982. The board issued a total of 855 "cease and desist" notices, referred 205 violations to the attorney general's office, and sent a total of 98 matters to the Governor and Council under s. 483-A:4 of the law, which allows the state to acquire a protective interest in the land after such a hearing. New Hampshire State Engineer Chamberlin reports that matters sent to the Governor and Council relate to RSA 482:41e, f, g and RSA 488-A which concern state grants of right to individuals to do work in state-owned great ponds. The Board's annual budget is about $100,000.

Mr. Chamberlin estimates 30 percent of all permit applications are in connection with septic system leaching fields: since state law requires these 75 feet from wetlands, people fill the wetlands to increase the setback! Another 30 percent may be docks, mostly on lakes. Also numerous are road accesses; and state roads impact numerous small wetlands.

The Board has enforcement powers, and Mr. Chamberlin states the attorney general's office will not act until the damage is "irreversible". Mr. Chamberlin reports the Attorney General has been helpful, though he will not enjoin ongoing unauthorized work unless damage is irreversible. He states all cases have been settled with restorative work and/or fines. Most violations are caused by homeowners and minor farm activities; much other minor work is done without any permit ("Where there's people, there's permits").

FEMA estimates 160 of the 250 New Hampshire municipalities have local floodplain controls which probably involve wetlands areas. One hundred eighty-eight communities have conservation commissions which review Board applications.

COE Activity in New Hampshire

In spite of state enforcement problems, Mr. Chamberlin has little use for COE except for major projects in rivers or harbors (e.g., Connecticut River fill in Stafford, Vermont area). He estimates the Corps might have

404 jurisdiction on 50% of the inland permit applications. There has been no coordination until recently. The Board is now considering an information sheet on 404 for its town-level package, pursuant to a letter from the COE pointing out that violations are occurring.

New Hampshire has no joint arrangements with the COE. The Corps reports 30 permits during FY 1981, including letters of permission and illegals; 21 of these were section 404 and section 10/404 which might relate to wetlands.

The state denies any significant problem in controlling the use of its wetlands (Downing letter to OTA) and complains of confusion over COE jurisdiction. Mr. Chamberlin says the confusion over COE jurisdiction revolves around determining whether a nationwide v. regional v. individual permit is required. However, the New Hampshire Wetlands Board was notified in February of 1982 by letter from William Lawless (Chief of the Regulatory Branch) of investigations of filling violations throughout the state. An explanation of Corps jurisdiction was included with the suggestion that the state might do a better job of informing its citizens about 404. (As noted in other state reports, the Corps is frequently criticized for not advertising its own program.)

Example Involving Major Wetlands Work

Research uncovered one particularly interesting project involving both vegetated wetlands and complex jurisdictional issues. The major North-South Interstate I-93 in New Hampshire (applicant, Federal Highway Administration) was commenced after an EIS was completed in the early 1970s. The document was determined invalid because in violation of NEPA and deficiencies were corrected after an injunction. However, the EIS process was prior to active COE involvement in the Clean Water and Endangered Species

Acts. Both ends of the construction were completed before the middle section through Crawford Notch in the White Mountains, which needed a permit from the Corps. Since a change of corridor was no longer possible, the Corps was not in a position to deny the project. However, due to the low population density of the area, the need for the highway was questioned. The proposed route cut across two extensive wetlands, a stream and a reservoir. Although the area was reported to include 7 endangered species, neither the Fish and Wildlife Service nor EPA had objections to the project; so the Corps decided to allow it. Jurisdication questions were complicated by the early EIS and the passage of protective legislation. Scoping meetings for a new EIS are now in progress.

MAINE

Wetland Laws

Maine has had a coastal wetlands protection law (ME. Rev. Stat. Ann. Title 38, ss. 471-476) since 1976 (it was originally found in MRSA ss. 4701-09). The law requires a permit from the state Board of Environmental Protection before anyone may dredge, drain, fill or erect a permanent structure in, on, or over sand dunes or a coastal wetland, defined as land subject to tidal action or normal storm flowage.

The values protected by the statute include recreation, navigation, wildlife, flow, fisheries, water quality and prevention of erosion. Notice is sent to affected municipalities and their comments are considered.

Another law (12 MRSA 4751-58) follows the pattern of the Massachusetts Coastal Wetlands Restriction Act in authorizing the same state Board to issue restrictive orders on coastal wetlands to be recorded in the chain of title of affected land. The values protected by this law include safety, health, property, water supply, wildlife and fisheries. Exemptions are narrow: boat moorings, snow dumping, maintenance and repair; procedural requirements may be waived for some sewage disposal in coastal wetlands (11/1/79 Regs.). Agricultural/silvicultural activities are not exempt.

Maine has no inland wetlands law, but recently enacted an inventory. However, large-scale development throughout the state is governed by the Site Location of Development law (38 RSMA s. 481 et. seq.) which requires a permit for large projects, including industrial developments requiring an air or water pollution license, developments occupying a land area over 20 acres in size, structures in excess of 60,000 square feet of

that the lower courts have found ways to "distinguish" later cases from the Johnson decision. It should be noted, however, that there are still numerous (as many as 40) small residential filling operations going on in saltmarshes in the town of Wells, both violations and permit applications.

Institutional

Although there are a number of dredging, dock, pier, etc. projects along Maine's 350-mile coastline, DEP reports very little activity in coastal wetlands which comprise approximately 17,000 acres. It is not possible to estimate department costs since six department people work on several kinds of programs. CZM reports indicate 354 permit applications under the coastal wetlands law 10/80 - 9/81, of which only a quarter were or might be related to wetlands. CZM Planner Alec Griffin reports that a recent enforcement study showed 10 percent to 20 percent of work generally was being done without a permit, but the projects were small. Tico Brown of DEP estimates very little illegal wetlands fill, except for special problems in Wells.

In Maine, unlike any other New England state, the DEP uses a joint application form with the COE, and may hold joint hearings though applications are processed separately. However, this is limited to coastal areas; inland wetlands are regulated separately by the COE. Possibly because of the joint form, Maine ranked second, behind Connecticut, in the level of COE activity in both FY 1980 and 1981. In FY 1980 there were 39 S. 10/404 coastal permits and 27 s. 404 inland permits issued. In FY 1981, coastal 10/404 permits had risen to 41; 26 inland 404 permits were granted.

An Example of Major Wetlands Work

Wells, Maine, has recently had more than 40 problems related to s. 404. The major problem stems from the EPA sewer line construction grant program. The line cut acrosssalt marsh behind a developed barrier beach with excavation and backfill material given to residents in the neighborhood. The result was a rash of small fills in the marsh extending backyards. The area abuts the Rachel Carson Wildlife Refuge. The Corps is currently investigating.

VERMONT

Wetland Laws

Vermont reportedly has approximately 180,000 acres of freshwater wetlands.

The state has no specific legislation protecting wetlands, although it has several times considered passing one. The famous land use planning law called "Act 250" passed in 1970, (10 Vermont Stats. Ann. Ch. 151, ss. 6001-91) permits regional boards appointed by the state and the state Environmental Board on appeal, to consider a number of wetland-related environmental impacts of projects, including water pollution, waste disposal, flood plains, shorelines, soil erosion, aesthetics, natural areas and wildlife habitat (Title 10 s. 6086).

According to a draft report of the Agency of Environmental Conservation's Department of Water Resources and Environmental Engineering (Water Quality Division), potentially significant development activities not covered by Act 250 include: permanent logging roads below 2500 feet; industrial and commercial developments less than one acre in size (or less than 10 acres in municipalities with both permanent zoning and subdivision bylaws); residential developments on fewer than 10 lots; housing projects with fewer than 10 units; and agricultural work where wetlands are drained or filled to provide more farmland. Except above 2500 feet, the jurisdiction of the law depends on the type and size of the land tracts involved and not upon where development will be located.

The cumulative effects, in particular, of wetlands fill under this system could be severe. Furthermore the regional implementation of the

law by la commissioners and reduced state input means there is no consistent way to review and evaluate sites. Where expert testimony on wetlands has been given to the Regional Commissions, Act 250 has protected wetlands (e.g., Colchester Bog, Pryder Pond, St. Johnsbury/Lyndon Industrial Park). Where no one provided this information, values were not protected (e.g., Northern Connector case in Burlington, where COE may ultimately require state to mitigate wetlands damage by replacing nearby wetlands). The Agency of Environmental Conservation (AEC) report recommends that the Agency establish a policy on wetland conservation to guide local planners and that the Environmental Board adopt procedures or rules to carry out provisions of s. 6086 as to wetlands criteria. For example, the Act 250 application form does not now require information on wetlands on the site. An Act 250 permit was denied for a residential development when evidence established that stormwater runoff and septic tank effluent from the development would have an adverse impact on Colchester Bog. Wetlands were also at issue in at least two other Act 250 administrative decisions.

Wetlands have not played a key part in any of the Act 250 cases decided in the courts. There are other minor laws (such as shoreline and municipal zoning) which may help to protect wetlands in Vermont.

Institutional

No numbers are available as to the acreage of wetlands involved with Act 250 permits. The number of new permits issued each year is approximately 500. The state AEC estimates 50-100 acres of wetlands are filled

annually (Commr.'s letter to OTA 6/14). According to William Countryman (Aquatech consulting firm, Burlington, formerly Act 250 district commissioner and then member of state Environmental Board, 1970-77), practically no significant wetlands issues arose under the Act in his experience. He believes 404 is important because it is all the protection wetlands get: but he would prefer a state law. He suspects small wetlands fillings take place throughout the state.

Stephan B. Syz, DEC water resources planner, would favor stronger state controls over wetlands rather than reliance of COE jurisdiction, which he feels is delusive. COE should maintain jurisdiction in large international waters such as Lake Champlain or Lake Memphramagog. Al Larroway (COE, Burlington) says New York Division normally does not issue 404 permits until all state permits are obtained.

Some Examples Involving Major Wetlands Work

1. Northern Connector, Burlington, sponsored by Vermont Agency of Transportation. Approved by regional commission under Act 250 with no objection or testimony from state AEC or public; wetlands impact omitted, but up to fifty acres of wetlands along Winooski River may be destroyed. COE received permit application under 404, though Transportation is seeking exemption on wetlands area at northern cloverleaf on grounds that those wetlands are not contiguous to river (hence no 404 jurisdiction); 30 day notice will be going out soon. Burlington COE engineer Al Larroway reports no public hearings have been held by New York Division COE in the 3.5 years he has worked there. It is expected United States Fish & Wildlife Service will seek mitigation rather than reroute road.

2. Sherburne Corp. obtained Act 250 permit to fill 8 acres on Reservoir Brook, branch of Ottaquéechee River in Sherborne for Killington ski complex parking lot; district commission found wetlands of insignificant value. COE received permit application from the corporation. The site involves a chain of wetlands and transitional areas and beaver dams. There are inadequate culverts under the road. The state required a 25' buffer from the brook. Corps staff inspected the site to determine the type of permit necessary. Presently it appears that a nationwide permit will be allowed for the two acres on the west side of the road, with an individual permit for 4-5 acres on the east side. When a project is split up, the applicant generally has the option of submitting one application for the individual permit.

3. Burlington Woodchip Power Plant got a permit under Act 250 and obtained exemption from COE on grounds that wetlands (acreage unknown) were not contiguous to Winooski River.

4. The New England Powerpool's D.C. Electric Transmission Line, proposed for either New Hampshire or Vermont, to transmit Quebec's hydroelectric power to New England, involves numerous companies and local, state and federal agencies. Department of Energy is the lead agency with Argonne National Laboratory preparing the EIS. The Corps is a cooperating agency on the EIS, to insure that adequate information is generated to form the basis of any permits required. Wetlands may be an issue in current proposal to run transmission lines from Canada to Massachusetts border. Originally routed through Moose Bog, a wetland of high priority according to the Nature Conservancy, has been changed. The new route contains some wetlands. COE is not yet involved.

COMPARISON OF STATE WETLAND'S PROTECTION PROGRAMS IN NEW ENGLAND

In general, evidence supports a conclusion that state wetlands protection programs in New England have been at least modestly successful. This conclusion is warranted by the data obtained from this regional survey.

However, there are many aspects of each program which appear to be at least improvable. The following aspects of the various programs are worthy of comment in support of these two general conclusions.

1. There are desirable and undesirable aspects of each state program. Some of the salient points in this regard are as follows:

   a. "Desirable" Features.

      -All state programs in New England except Maine and Vermont give at least some discretionary authority to local governments "where the action is". In Massachusetts, full responsibility is given to municipalities to initiate action with only a reservation of state power to intervene where local communities do not. In Rhode Island, local denials of freshwater wetlands projects cannot be overruled by the state. In Connecticut, all but 15 municipalities have taken over the program from the state by adopting state-sanctioned local procedures. In New Hampshire, local communities are invited to comment on all project proposals.

      -Each state program (except Vermont), considers an array of commonly-accepted wetland values with Rhode Island's freshwater program most thoroughly comprehensive in scope and analytic methodology.

-With minor exceptions, state programs in New England cover most actions which are or could be destructive of wetland values.

-In all states with coastlines, coastal regulatory programs appear to be especially successful.

-In all New England states there are local programs such as building and zoning controls which supplement formal wetland control programs.

b. "Undesirable" Features.

-Local administration of programs in states which authorize it is acknowledged to be variable in terms of both expertise and level of activity. For example, in Connecticut, where there is no oversight at all of local programs once they are approved, some towns such as North Haven have permitted a great deal of wetlands work in a river system which impacts other towns.

-State programs, on the other hand, especially if they are not enthusiastically supported by local officials, suffer from constant budget threats. For example, threatened cuts in CZM funding could cut Massachusetts DEOE's budget in half.

-None of the states are really using the COE s. 404 program to its fullest potential, for a number of reasons (some discussed elsewhere), including:

-lack of public knowledge of 404 program

-difficulty of comparing state data with 404 files

-centralized COE office, making access hard for most of New England (and this will be exacerbated by recent

decision to make New England Division a District, subject to the Northeast Division in New York), and

-visible contempt and suspicion of many state officials for COE wetlands program (as opposed to traditional structure) apparently derived from "turf" jealousy and a belief that COE does not really care about wetlands.

2. Vermont has no specifically-oriented wetlands protection act or program, and its governmental sanctions which have this potential to control environmentally damaging wetlands actions (such as local zoning and the state's Act 250) are not adequate to deal with wetlands incursions.

3. Maine has a coastal wetlands protection law administered exclusively by the state and designed (as also in the case of Connecticut) to be administratively collaborative with the Corps' 404 program. But, like Vermont, Maine has no comprehensive inland wetlands law, and its Site Location of Development law is designed to cover only large development projects.

4. New Hampshire and Rhode Island have state wetland laws covering both coastal and inland wetlands, but administered by each state with limited local involvement. In the case of New Hampshire, local communities are encouraged to comment, but comments have no necessary bearing on the state's decisions. In Rhode Island, local communities have power to deny a permit for work in inland wetlands, but have no permitting authority per se, i.e., all applications for permits are made to the relevant state agency.

5. Massachusetts and Connecticut also have state wetland laws covering both coastal and inland wetlands. In Massachusetts local communities

are mandatorily involved in the administration process. Connecticut communities may voluntarily assume control of inland wetlands.

6. Rhode Island and Connecticut administer coastal and inland wetlands programs separately, through two separate and distinct state agencies and laws. Rhode Island argues that this permits the state to apply appropriate expertise to two distinctly different problem areas. Single-agency states like Massachusetts and New Hampshire argue that unity of command considerations are vital to successful administration of a state-wide wetlands program. Both lines of argument clearly have merit.

7. The proper role of local communities is also argued among the New England states. In keeping with classical public administration theory, governments should yield authority to higher levels of government only where in situ administration is not appropriate for in situ decision-making, whether because of jurisdictional or functional limitations. Most wetlands development proposals (except highways) eminate from within a single municipality. It therefore follows that local bodies should be responsible at least for preliminary determination of proposal suitability (even if local governments do not have a wealth of expertise to make wetlands decisions). This, at least, is the apparent presumption behind "first action" options given to local communities in Massachusetts and Connecticut. Rhode Island is territorially small and has been willing to trade the fine-honing advantage which local determination might yield for the greater expertise which state agencies can bring to bear on the issues.

Critics of the Massachusetts method claim local enforcement is spotty. Critics of the Connecticut system claim that the state doesn't

really know what is going on in communities which have opted for local control. Critics of the Rhode Island system (and other state-level enforcement states like New Hampshire) claim the state agencies are too remote from local issues and are invariably limited by inadequate budgets. The Massachusetts WPA began as a state-level law and was given to local jurisdiction after 9 years of local dissatisfaction with state administration.

8. The New England states also differ in their views of wetlands jurisdiction. The region's states differ dramatically all the way from Vermont's apparent view that land use (not wetlands use per se) should be the subject of concern to Massachusetts where, according to A. Dawson, the "law applies on its face to every floodplain puddle and catkin clump."

But in all New England states there are ways in which wetlands can be developed and wetland values lost. Every state has some version of initial applicability determination. In Rhode Island no vegetated wetland of less than an acre in size is even considered. In Massachusetts, some communities have bent the law by ruling it inapplicable to minor wetlands proposals. Critics of the Rhode Island approach point out that applicants tend to propose projects which almost, but not quite, meet minimum size requirements which would require permits. In all states there is the unanswered suspicion that backyard alteration and clandestine filling and draining, too small for aerial detection, may pose a long-term cumulative threat to wetlands which no state can successfully address administratively. It would be naive to assume that any state would be willing to give up the administratively manageable

concentration on "important" wetlands projects in order to run after a multitude of small violations, and state budget-makers are not likely to become liberal enough to permit both.

9. Wetlands laws in most states deal with an array of commonly accepted wetlands values. However, for political reasons, Massachusetts law omits wildlife values (except fisheries) and recreation values. Where permit authorities see a threat to wildlife values, their denial of a permit or specification of conditions for permit approval must be couched in evasive or rationalized language which does not directly specify what it is that bothers them, and such language fares poorly at higher levels of administration or in courts of law if a permit case is appealed.

10. There is consensus that coastal wetlands are better protected than inland wetlands in the five coastal New England states. This is attributed to (a) a high degree of pressure to develop coastal areas, resulting in greater public pressure to protect them, (b) a better state review derived from CZM budgets, and (c) greater public perception of value of saltwater wetlands. In any event, there appears to have been both a quantitative and qualitative improvement in level of coastal wetlands protection, exceeding any state's improvement level for inland wetlands protection.

11. Massachusetts, Rhode Island, and Connecticut wetlands program officials feel that work in wetlands "buffer" areas can be as important as direct tampering with wetlands themselves. Direct action is observable and reportable. Buffer zone actions may not be reported as wetland-related because the encroachment and damage is indirect; yet may be critical in the long-term. Developers, of course, consider buffer zone

legislation as merely "nuisance" jurisdiction. Indications are that a very large percentage of Massachusetts permit applications relate solely to work in the buffer area around vegetated wetlands.

12. Rhode Island, Connecticut and New Hampshire have devised informal procedures for dealing with minor work in freshwater wetlands; Massachusetts has not.

13. All state programs cover non-wetland activities. However, projects in wetlands are generally more controversial and more likely to have formal review.

14. A single major recommendation for each New England state program (proferred politely and with some trepidation):

    a. New Hampshire: change the state sanitary code and/or the state wetlands act to ban the filling of wetlands so as to distance them to the required 75' from septic systems. This is a travesty of the law and does not accomplish the desired sanitary purpose either.

    b. Vermont: change the Act 250 Regulations as suggested in the state study so as to insure that wetlands and wetlands work are clearly indicated on all plans submitted under the law and wetlands values are given full consideration. This would go a long way toward filling the gap caused by lack of a wetlands law.

    c. Connecticut: if it is not possible to create state appeal review of local decisions under the freshwater wetlands law, complete and accurate reporting of all local permits to the state DEP should be required. The state should then be funded to do

a critical annual report on local activities under the law.

d. Maine: An inland wetlands protection program should be inaugurated; if a new law cannot be passed, the activities of LURC and the Site Location Law should be linked to tougher local zoning requirements.

e. Rhode Island: the minimum-size exemption should be reviewed in light of data on cumulativity and to insure it is not being abused by segmented projects over time.

f. Massachusetts: should join all other programs in protecting wildlife habitat and recreational values as these now have strong public support, possibly lacking when the law was first passed.

g. All states: should drop suspicion, jealousy, and apathy and make use of the COE s. 404 program, especially overflights, mitigation experience, personnel expertise and political independence from local pressures.

The following Table 11 summarizes some of this comparative information. (However, due to the built-in limitations of tabular display, the reader should not use a perusal of Table 11 as an adequate substitution for a careful review of the preceding 8 pages of text.)

TABLE 11
SUMMARY ATTRIBUTES OF STATE WETLANDS PROGRAMS IN NEW ENGLAND

State	Values Protected (not all-inclusive)	Primary Admin. Agencies	Wetland Areas Regulated	Exemptions	Coordination with Corps	Activities Causing Wetland Losses
Ct.	Fresh Water: flood, water quality, rec. fish, wildlife, aesthetics, water supply, erosion, siltation, pollut. Salt Water: flood, rec., fish, wildlife, shellfish, aesthetics, eros'n, sedimentation, nav.	Local: Conservation Commissions (not actively regulated by state). State: Dept. of Env'l Prot. for 15 local communities	Wetlands defined by soil. Veget. wetlands up to 1' above extreme high tide.	Fresh Water: farm ponds, farming, boat moorings, munic. water supply, uses incidental to resid. property. Salt Water: navig. aids, public health emergencies, mosqui. control.	Joint Public Notice	Data too imprecise
Me.	Coastal: wildlife, fisheries, water quality, water sup. navig., rec.	State: Board of Envir'l Protection	Coastal: Vegetated wetlands.	Boat moorings, snow dumping, maintenance & repair, some requ. for sewage disposal.	Joint Appl. Joint Publ. Hearings	Data too imprecise
Ma.	water supply, fish, shellfish, flood, water pollution, groundwater.	Local: Cons. Commissions. State: DEQE on appeal	Vegetated wetlands plus 100' buffer zone	Mosquito control, Utility maintenance, Emergency work, Silviculture, Agricult.	Informal	Data too imprecise
N.H.	fish, shellfish, wildlife, plants, rec., aesthetics, groundwater levels, flood, siltation, "intersts of the general public"	State: Wetlands Board.	Fresh Water: Veget. wetl'ds Salt Water: Veget. wetl'ds up to 3.5' above mean high tide.	Maintenance. wetl's less than 1/2 acre or 20% of wetl'd area. Subdiv. less than 3 lots. No field insp. for min. impact work.	Informal	Data too imprecise
R.I.	Fresh Water only: rec., groundwater. Salt Water only: vegetation, scenic quality, erosion. Both: water supply wildlife, fish, shellfish, flood.	Fresh Water: DEM Freshwater Wetlands Sect. Salt Water: Coastal Resources Mgt. Council. Locals may deny	Fresh Water: Veg. wetl'ds plus 50'. Salt Water: Veg. wetl'ds plus 200'	Fresh Water: Less than 1 acre marsh. less than 3 acre swamp. Pond under 1/2 acre. River bank cut & fill if compensatory storage.	Informal	Data too imprecise
Vt.	no specific legis. State land use law regulates some wetland values.				Informal	Data too imprecise

U.S. ARMY CORPS OF ENGINEERS

Legal Requirements

It is assumed that OTA does not require a legal history of Section 404 of the Water Pollution Control Act Amendments of 1972, nor of the cases decided thereunder. The following review will therefore concentrate on the institutional efforts of the New England Division of the Corps in the context of its legal requirements.

The "404" Program operates under s. 404 of P.L. 92-500 as amended by the Clean Water Act of 1977. The statute is fleshed out by DOD Regulations published July 19, 1977, 42 FR 37122; EPA Guidelines issued December 24, 1980 (45 FR 85336); and United States Fish and Wildlife Mitigation Policy regulations (46 FR 7644, January 23, 1981, as corrected February 4, 1981). Together these form a matrix of regulations establishing such important and sometimes controversial elements as the following:

- Fish and Wildlife Service review without veto and EPA review with veto (but never used in this region).
- Exemptions for normal agricultural activities (not including change or land improvement for agricultural purposes) and silviculture.
- Definition of discharge of fill material to exclude waste disposal and therefore dumps or landfills. (COE believes EPA should control these with NPDES permits; EPA disagrees.)
- The bifurcated general permit program: (1) nationwide general permits and (2) regional general permits, the former applying everywhere, the latter to states or groups of states.
- Definition of wetlands by vegetation which coincides with state regulation in Maine, Massachusetts, New Hampshire, and Rhode Island, but not Connecticut which defines wetlands in terms of soils. (Vermont does not define wetlands at all.)

-The Corps emphasis on wildlife habitat and mitigation by replacement of lost habitat at more than par. Although wildlife is covered in Maine, Rhode Island, Connecticut, and New Hampshire (but not in Massachusetts), there is no formal state program or policy of mitigation of this kind in any New England State.*

COE is obliged to give great weight to state/local permit decisions, but is bound only by "federal consistency" review under Coastal Zone Management (CZM) legislation which requires most federal actions to be consistent with approved state plans. Generally the New England Intra-COE appeal ("elevation") procedures and deadlines are being made more rigorous without changes in statutes or regulations.

Institutional Review

The Corps processes s. 404 permits together with permits under the Rivers and Harbors Act. S. 404 permit applications frequently involve Rivers and Harbors permits, especially under Section 10. Because of jurisdiction specifications, 404 and 10/404 permit activity may involve work on water bodies, banks, and other areas as well as on vegetated wetlands; therefore, overall numbers do not yield information on wetland filling practices alone. Research using the New England Division (NED) files undertaken for this project was limited due to resource constraints, but it did attempt to focus on permits for fills in wetlands (see sampling description).

Data by state and type of permit in Tables 12 and 13 provide a background for this analysis of COE permit activity. In 1980, a total of 283 s. 404 and 10/404 permits were issued in the New England region. In 1981, the permit level at 289 was close to the same. The preponderance

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* Rod Gaskell reports that Massachusetts DEQE conditions imposed to mitigate harm and loss to wetlands are becoming more sophisticated. Generally, however, state and local officials have not believed they could impose conditions related to offsite property, whereas federal officials under the HEP program have (we are told) demanded that applicants buy up compensatory habitat. (This would have been required if the Dickey Lincoln dam had been built.)

Table 12. COE Permits Reported on by Type and State, FY1980.

	TYPE							
State	Letter of Permission	Coast Guard Sec.9	Illegals	Section 10	Section 404	Section 10/404	Section 103	Total
CT	9	1	8	22	21	69	0	130
ME	14	7	6	31	27	39	4	128
MA	18	2	6	43	19	48	7	143
NH	4	2	2	4	22	4	0	38
RI	4	0	0	19	0	12	0	35
VT	7	0	11	14	10	12	0	54
TOTAL	56	12	33	133	99	184	11	528

% Northern New England = 42%

% Southern New England = 58%

% Section 404 (Inland) = 23%

% Section 10, 103 and 10/404 (Coastal) = 77%

Table 13. COE Permits Reported on by Type and State, FY 1981.

	TYPE							
State	Letter of Permission	Coast Guard Sec.9	Illegals	Section 10	Section 404	Section 10/404	Section 103	Total
CT	16	1	4	28	25	59	2	137
ME	13	14	1	19	26	51	2	126
MA	21	5	2	57	22	39	6	152
NH	6	0	3	4	14	7	0	34
RI	12	1	1	16	3	11	0	44
VT	4	0	8	6	17	15	0	50
TOTAL	72	23	19	130	107	182	10	543

% Northern New England = 39%

% Southern New England = 61%

% Section 404 (Inland) = 20%

% Section 10, 103 and 10/404 (Coastal) = 59%

of activity was concentrated in the states of Maine, Connecticut and Massachusetts. It should be noted that COE data include only individual permits, because no application is required for nationwide permits (i.e., they are qualified exemptions). Records indicating nationwide permit activity only reflect cases of formal inquiry and subsequent formal notification by the Corps. Starting in 1982, no application will be required for regional general permits. COE does not maintain data on numbers of requests from the public for information. Also, as noted, the gross figures do not indicate type of wetland nor type of wetland activity.

According to COE Summary Reports, NED has jurisdiction over 0.5 percent of the total United States miles of river and coastal shoreline, and 0.4 percent of the total United States square miles of wetlands.* Regulated coastal wetlands represent 97,280 acres in New England and regulated inland wetlands acreage is 510,720. (See excerpts from COE "Impact Analysis" report of November 1981 which accompanies this submission to OTA.) Although these figures are the smallest of any COE division, the geographical area covered by NED is also the smallest in the contiguous United States. With the exception of the Pacific Ocean Division, New England has the lightest permit load.

The disposition of applications in New England reflects national trends. The percentage issued has been 85.2 compared to 82.9 Corps-wide, with 13.9 percent cancelled or withdrawn as contrasted with 15.7 percent for all divisions. According to NED staff, denials in New England are few because of success in getting applicants to modify plans. While the percentage of denials in New England is smaller than average (0.9% compared with 1.48%

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*Visual inspection of physiographic maps alone appears to challenge the accuracy of both of these percentages. New England's land area is 1.8 percent of the area of the 50 states and a larger percentage of this area abuts the ocean than is true for the other 44 states as a whole. Given character of topography and soil and evenness of annual precipitation, the same generalization should apply to acreage of wetland. (Editor)

nationally) denial of permits represented only a small percentage of applications everywhere (ranging from 0.2% to 3.4%). It is possible, however, that differences in District policy and state regulatory procedures may render these figures misleading. The number of denials issued by COE in New England independent of state or local denials is far less than even the low COE percentages indicate. It is not known how New England compares with other divisions in the denial of permits on COE's own initiative, independent of state agencies' decisions (see section describing NED denial basis).

In New England, the COE 404 program accounts for about 20 percent of the total COE permit activity, a figure which equals the national average according to regulatory program summaries. However, combined applications under Section 10/404 account for an additional 34 percent. So more than a half of COE permit activity in New England is involved in some way with s. 404. Tables 12 and 13 show the permit activity of NED in New England for 1980 and 1981.

A 1981 Center for the Environment and Man (Hartford, CT) report (No. 4280-06-732) entitled "General Permit Study for the Six New England States" reviewed 765 1979 and 1980 COE-NED individual permits. The study shows that 26 percent of the permits reviewed and which authorized a single activity, involved fills, but that only 8 percent affected vegetated wetlands. Section 10 and 404 accounted for 40 percent of these permits, with 19 percent pursuant to s. 404 alone. Most projects received no objection during the review process and plans were approved as submitted in 88 percent of the cases. Objections were received from the public in three categories: general only (18%), agencies only (8%),

and both groups (4%). Although mitigative measures were more likely to be included if objections were expressed, clearly, objections by themselves do not guarantee mitigation. Following is a general breakdown:

No objections and no mitigation	65%
Objections but no mitigation	22%
Objections and mitigation	8%*
No objections but mitigation	4%

Public hearings were held as a result of 5 of the 765 applications, or less than 1 percent of total permits.* The time period between application and the granting of a permit was 174 days or about 6 months. An important conclusion of the CEM report is that, although long-term adverse environmental and social impacts represent a small 7 percent of the total, they fall disproportionately on wetlands (see Table 14). Of long-term adverse impacts identified, one-half affect wetlands, with 20 percent more affecting benthic flora and fauna. Long-term beneficial impacts to wetlands were identified in only 2 percent of all permits. An examination of fill projects in wetlands again demonstrated the large number of adverse impacts and also a high degree of controversy as indicated by the number of objections received (Table 15). Due to these characteristics of wetlands activities, CEM concluded that permits for fill in wetlands should not be considered in any possible revision or expansion of the general permit guidelines.

COE permit applications are routinely reviewed by other federal agencies (EPA, National Marine Fisheries, U.S. Fish and Wildlife Service) through joint processing. According to a June 1981 EPA memorandum, 90 percent of applications (about 450/year) are assessed through

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*We have no information on how data on objections and mitigation apply to vegetated wetlands cases, and we cannot tell whether the public hearings related to vegetated wetlands cases.

Table 14. Ranking of Long-Term Adverse Environmental and Social Impacts of 1979 and 1980 Permits Issued by COE-NED.

Environmental/Social Criteria	Numbers of Permits*	Percent of All Permits*
Wetlands	59	8.0
Benthic Flora and Fauna	21	3.0
Wildlife	8	1.0
Recreation	5	0.7
Air Quality	5	0.7
Water Quality	4	0.5
Finfish/Plankton	4	0.5
Navigation	3	0.4
Flood Damage Prevention	3	0.4
Noise	3	0.4
Safety	2	0.3
Circulation Patterns	2	0.3
Erosion/Accretion	2	0.3
Land Use Classification	1	0.1
Historic Values	1	0.1

*Counts do not sum to 765 and percentages do not sum to 100, since multiple impacts of a single permit were possible. Wherever possible, percentages were rounded to the nearest integer value.
Table from Report No. 4280-06-732 of the Center for Environment and Man.

TABLE 15

CLASSIFICATION OF SINGLE-ACTIVITY** FILL PERMITS INVOLVING WETLANDS (BY PERMIT NUMBER) ACCORDING TO OBJECTIONS AND LONG-TERM ENVIRONMENTAL IMPACTS
(Number of objections indicated in parentheses)
(Five digit numbers indicate individual cases)

Long-Term Impacts on Wetlands	Agency Objectors	Public Objectors	No Objectors
None	80181(3)	80177(7) 80284(4) 80290(1)	79013 80052
Beneficial	79365(2) 80320(3)*	79157(8) 80320(23)	80332
Adverse	79053(1) 79156(4) 79257(3) 79266(2) 79366(1) 80313(1) 80084(1) 80325(2)	79081(1) 79069(5) 79193(16) 79211(1) 80048(2) 80063(7) 80079(5) 80129(3)	79030 79259 80257 80330

*Permit number is listed twice, since both agency and public objectors are involved.

**There were also 29 "multiple activities" permits not listed here. Some or all of these may have involved fill.

this method of expediting review initiated in New England in late 1979. From October 1, 1979 to March 31, 1981, 715 Section 10/404 and Section 404 permits were reviewed, with most review time devoted to "major" (wetland fill greater than 5 acres) and "important" (wetland fills of 2-5 acres and less than two acres case by case) projects. Both of these types of projects combined represent about 1/2 the case load but receive a disproportionate amount of staff time and are more likely to be the subject of EPA objections. This corresponds with staff impressions and CEM report findings that wetlands fill projects tend to evoke controversy.

Of the 715 permits studied, EPA action is as follows:

No response	2.5%
No objections	30 %
Recommendation for modification:	
Standard conditions	11 %
Case specific	8 %
Recommendations for denial:	
Standard conditions	1.2%
Case specific	5 %

(Note: Percentages do not total 100 because EPA did not report on its review of all 715 cases.)

Of the total recommendations for permit approval with modifications two-thirds were resolved by the applicant's acceptance of conditions imposed or negotiations to resolve difference were successful. In the remaining cases, EPA withdrew its recommendation or negotiations were still in progress. In cases where EPA recommended denial, the differences

were resolved with the applicant in 26 percent, EPA withdrew its recommendation in 21 percent, the Corps issued a permit without requiring modification in about 10 percent, and the Corps denied the permit in 21 percent. (The remainder await resolution.) Thus, although the Corps issued permits in some instances in spite of EPA's recommendation for denial, the study indicates that none of these cases were, "elevated" (formally appealed). The record shows only one application referred to the Division level (a permit for a marina/port).

As seen in Table 16, slightly less than one-half of the permits issued were identified as projects which might affect wetlands. Although the purposes of the projects listed have the potential to affect wetlands as defined for the purposes of this study, certainly a much smaller percent actually do. However, the breakdown does show the relative frequency of projects which may involve wetlands.

A few remarks from EPA and Corps staff regarding the effectiveness of wetlands protection in the context of the different types of projects are worthy of consideration. A large number of applications involve construction, expansion, or maintenance of highways and other roads. Here, early coordination is imperative, before EIS scoping or corridor selection. Otherwise modifications, even in alignment, are difficult to make. Minor conditions to control sedimentation and prevent erosion are more easily imposed. Local road projects are also difficult to modify in regard to siting; the cost of relocation is the usual reason given.

Although levees and weirs do not seem to cause permit conditioning

Table 16. Purposes of COE Permits Reviewed by EPA.

	% projects of 485 total	% potential veg. wetlands projects
Agriculture/silviculture*	2	5
Residential	4	8
Industrial (and commercial)	7	14
Marinas/ports	5	11
Highways/roads	15	30
Pipelines/sewers	5	10
Water resource development (levees, weirs, dams)	8	16
Solid waste disposal	2	4
Drainage work	1	2
Other: (not involving vegetated wetlands)		
-oil and gas exploration -piers/docks -channelization -ocean disposal -erosion control (bulkheads, riprap) -navigation-related improvements	> 51%	0%

* Agriculture/silviculture projects requiring permits include activities such as major drainage, new use of an area for agriculture, expansion of project into area not in agricultural use, and some roads for silviculture.

Table compiled from Corps of Engineers, New England Division Data

problems, dams for hydroelectric power, water supply, flood control, and/or recreation were noted as a source of contention in agency review. These projects are most common in northern New England, and therefore do not appear in the indepth reviews of Massachusetts and Rhode Island. The applicants for these types of projects were singled out as being the most recalcitrant in considering modifications suggested by the agencies. They also were reported to successfully evade major modifications.

Residential and industrial/commercial developments were identified as generating great controversy. The projects are conditioned on a case by case basis because of the variations, but usually involve site design or orientation alternatives to reduce the amount of filled area. However, the modifications recommended can be substantial, causing major alterations which may render the project unfeasible. Mitigative options, such as creation of new wetlands, may then be advised.

The New England Division Regulatory Branch has 31 full-time positions, about a third of which are involved in 404 wetlands cases. This number of personnel was considered grossly inadequate by COE and EPA to properly evaluate the large number of permits. Staff assigned to areas for which they are responsible are spread throughout New England, scattered among several states. There is consistency in that they become familiar with problems and politics of their specific areas. Although all staff are aware of the various state programs and procedures, no staff member has a good overview of any individual state's performance as protector/regulator of its wetlands.

Citizens usually learn to apply for permits from the engineers in charge of their projects who are familiar with Corps requirements.

There is a joint application for Maine for its state program and the Corps. Connecticut has a joint public notice form for the public review process and joint public hearings are now under consideration. Rhode Island has applied for delegation of the 404 program (inland only; coastal waters would not be affected); currently Rhode Island informs applicants to its state programs that a Corps permit may be necessary. The Massachusetts and New Hampshire programs are entirely separate from the Corps.

When applicants contact the Corps, they are sent information and an application. Some projects are weeded out over the phone; callers from states with buffer specifications can be told that an application is not required if no other parts of the project would be included under the Corps regulations. Upon receipt of an application, staff review the plans to determine whether an individual permit is required. Distinctions between nationwide and individual permits often can be made using drainage area maps; for example, if the stream drainage area exceeds 3 to 5 square miles (depending on topography) flow probably exceeds 5 cfs, requiring an individual permit.* The method for calculating the 5 cfs limitation is apparently not particularly controversial, being accepted by engineers. Sometimes, however, the data fed into that method is disputed (e.g., were the slopes properly calculated). If the determination is not clearly for a general permit, an individual permit will be required.

The public interest review process includes a 30 day public notice period during which comments are received. The mailing list is a standard one for each state (newspapers, officials, environmental groups, contractors) and includes a list for the specific project, including town hall personnel, conservation commission members, and abutters. Anyone

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*Runoff in New England is estimated at about 1.5 cfs per square mile of drainage area.

can request to be on the Corps mailing list. Comments from the public were considered to be of good quality and useful.

The public notice includes an explanation of the public hearing process. A public hearing can be held if someone requests one, with a statement of good reasons. Also considered are the scope of the project and the number of requests. The Corps contends that public hearings are held only to understand objections or gain information from the public when written comments will not suffice. If a public official at any level requests a hearing, one will probably be held. However, in New England public hearings are rare, averaging only 3-4 a year. NED staff state:

> Public hearing procedures are one of the most misunderstood facets of the Regulatory Guidelines. We only hold a Public Hearing on a case if we think we can gain more information or cover issues that have not already been raised by the Public Notice. We are not obliged to hold a (hearing) simply because someone requests one.
>
> Hearings, due to their high cost, are only held when that is the best forum to understand a diversity of objections. Usually there is little reason to hold a hearing.

The joint processing procedure brings together the players at the federal level, EPA, Fish and Wildlife Service, NMF, and the Corps. The application is presented at a monthly meeting, with comments and photographs provided by staff of one of the agencies, a staff member of which has visited the site. The project is evaluated and the agencies recommend permission, denial, or special conditions under which the project must be done. If the various agencies differ in their assessment of a project and are unable to reach a compromise, a memorandum of agreement between the agencies provides for appeal, "an elevation" to a higher level.* The opinions of the agencies are included in the Findings of Fact record of the Corps. If a permit for the project is denied for any reason on any other level, local, state, or federal, the Corps will issue a denial. The NED of the Corps rarely denies projects on its own, perhaps one or two a year.

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*Revised MOAs have changed rules on elevation.

Under its discretionary authority, the Corps can require an individual permit for a project covered by a general permit. The figure for frequency of such actions was less than one a year. Two such actions still in process are D'Annolfo's Industrial Park, Woburn, and the Attleboro Mall, both in Massachusetts. Both involve issues of water quality and the headwaters (< 5 cfs) exemption allowed under nationwide permits. In both cases, COE responded to widespread citizen protest expressed in direct requests by the Massachusetts Association of Conservation Commissions and others that the COE require individual permits.

In these two Massachusetts cases, the COE asserted discretionary authority because they "thought the projects would cause problems, not simply because of citizen protest, although that initiated consideration."

Monitoring and enforcement are limited by staff and budget constraints. Aerial reconnaissance is carried out weekly, with locations chosen on the basis of staff request. The resulting photographs are used for permitting and enforcement. Local residents are also an important source of information to Corps personnel about violations. Enforcement including legal action and fines, is handled by enforcement personnel within the Regulatory Branch.*

One staff member expressed the opinion that nearly all of the activities that needed permits along the coast obtained them prior to activity or were reported as violations; few eluded attention.

A trend has been noted towards more active, and stricter, involvement in wetlands protection since a change of higher level personnel.

Analysis of a Sample of COE-NED Permit Cases

The data in the Corps offices in Waltham are stored in files and on microfilm. Section 404, Section 10, and Section 103 files are not separated. Nor is there any separation by state. Which communities

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*Violations are usually punished by fines and "remedial action"--e.g., fill ordered removed. A general injunction on further work on a project can be quite a punishment in itself, if the project involves major money. We know only one person jailed for violation of the Massachusetts Wetland Protection Act (not for filling but for contempt of court in failure to remove illegal fill as ordered).

are involved can only be learned from the file as the indexing system gives only an application number, applicant name, U.S. Geologic Survey quadrant, date, permit number, and type of activity. Thus, unless the name of the applicant is known, (which may or may not be the same as the name given for a state permit) it is almost impossible to locate a particular case. Because of the categories used for the type of activity, it is also impossible to determine (without examining the file itself) whether a fill project affected vegetated wetlands.

A total of 48 cases were reviewed for the year 1981, including all fill projects in the six New England states. In addition, for Massachusetts and Rhode Island, 20 files were studied for 1980 and 16 files for 1979, representing the fill projects that appeared to affect wetlands for those years.

The procedure for sampling data in the Corps files was to identify fill projects from the monthly reports of permit actions. Projects with the notations "Fill", "Fill-Parking", "Place Fill", "Fill Lot", "Fill-Industrial area", "Fill Apartment Construction", and "Fill-Resid-Subd" were included.* For each project, that state, USGS quadrangle, month of application, permit number, applicant's name, and information about the activities were collected from the microfilm record of the file. If a permit was not issued because of withdrawal by the applicant, if a permit was not required, or if the project was denied a permit, no information was noted. The "permit-not-required" cases included only a letter to that effect, and the withdrawn and denied applications were unavailable due to a reorganization of the file in progress during the site

*Fills such as "Fill-Submarine cable" and "Fill-floats" were excluded because such activities would in all probability not affect wetlands. It must also be conceded that actions other than filling per se may have important impacts on wetlands. The word "fill" was used because of record-keeping limitations.

visit of the researcher. Information noted includes special conditions (if any) and agency objections (if any).

An analysis of the gross numbers in the sampling yielded Tables 17 and 18. When the fill projects by state for 1981 are compared with Table 13 which gives the total permit activity for the 6 New England states, it is clear that the proportion of fill projects is not consistent throughout the region. Massachusetts and Connecticut have a large number of projects but Maine, with a high overall level of permit activity, shows very few fill projects. The reason for this discrepancy is unknown, although it is possible that much of the activity is coastal but not fill.

It is also apparent that the COE permit activity load includes many applications which do not entail the issuance of an individual permit. Table 18 shows that a little less than half of the NED applications result in individual permits. Applications withdrawn may, in some circumstances but not necessarily, result from conditions to the permit which are unacceptable to the applicant. More likely are changes in financial circumstances. As previously explained denials do not reflect decisions independent of state permit outcomes.

A review of summarized project information drawn from 36 files in the sampling effort indicates some of the trends in COE wetlands permit activities (see Table 19 for details). The purposes of the projects are as follows:

Table 17. COE-NED Fill Projects by Year and State.*

		No.	Σ
1979	MA	16	16
	RI	0	
1980	MA	17	20
	RI	3	
1981	MA	21	48**
	RI	1	
	CT	16	
	VT	2	
	NH	5	
	ME	3	
		TOTAL	84

*1979 and 1980 data are for Massachusetts and Rhode Island only.
**The total number of actions recorded on the monthly report of permits for 1981 is 651. Both this total figure and the 48 fill projects excerpted include withdrawn applications, nationwide and regional permits, denials, none required, and combined applications (see Table 18, Disposition of Applications).

Table compiled from Corps of Engineers, New England Divison Data

Table 18. Disposition of COE-NED Permit Applications. (Fill Cases 1979-1981.)

	No.	%
Individual permit	40	48
Nationwide permit	10	12
General permit (regional)	2	2
Permit denied	3	3.5
Application withdrawn	12	14
Permit not required	14	17
Application combined with pending application	3	3.5
TOTAL	84	100%

Table compiled from Corps of Engineers, New England Division Data

Table 19. Summary of a Sample of COE-NED Project Characteristics.

State	Purpose	Coastal or Inland	Type and Amount	Objections	Special Conditions
CT	residential	tidal marsh	1800 ft^2	yes/CC and abutter	0
MA	riprap erosion control	river	N/A	N/A	N/A
ME	residential	coastal	rock fill	N/A	N/A
CT	marina	coastal	existing (no permit)	0	N/A
MA	road	inland	1290 yd^3	Yes	5 compensatory wetland and sed. control
ME	erosion control	river	N/A	0	yes riprap
MA	parking lot	inactive canal by river	N/A	0	yes (minor)
MA	office/parking	inland	2 acres	yes/FWS rec. denial	0
NH	road relocation	inland	wetland 16,300 ft^2	FWS/rec. denial/ w/out mitigation	0
CT	I/C	tidal river	N/A	N/A	6 sed. cont.
CT	erosion control	harbor	N/A	N/A	N/A
MA	bridge and road	inland/ river	1.7 acres filled	FWS recom. alternative	yes/location disposal
CT	road	coastal	215 yd^3 fill	0	N/A
CT	I/C	man/made canal	N/A	FWS recom. further dredging	0
CT	road	inland	N/A	yes	2 FWS/EPA recom.
MA	industrial	inland	16,000 yd^3 fill	denial recom. FWS/EPA	(4) and miti. plan
MA	parking	inland	sm. (¼ acre) fill large wetland	denial recom. FWS/EPA	0 (COE-no feasible alternatives)

Table 19. Summary of a Sample of COE-NED Project Characteristics.* continued

State	Purpose	Coastal or Inland	Type and Amount	Objections	Special Conditions
MA	hotel	?	4,000 yd^3 fill	F&W opposed EPA rec. altern.	0
MA	road	inland	233,000 yd^3	EPA/FWS	miti. in special conditio
ME	residence	?	60 yd^3	FWS	FWS 1st den. then 1
MA	road (access and water supply	inland	4,000 yd^3	N/A	0
MA	erosion control	coastal	N/A	N/A	N/A
MA	residential	inland	N/A	abuttors only	0
MA	landfill	inland/ near river	20,000 yd^3 fill	LPVRPC/CRWC req. for hearing denied	yes - part of comp. landfill wildlife refuge
MA	residential	inland	1,000 yd^3	N/A	0
MA	residential	coastal	N/A	N/A	0
MA	parking	river	5,500 yd^3 fill	FWS rec. denial	spec. cond.-artificial oxbox
MA	com. building	coastal	11,000 yd^3 saltmarsh	N/A	fill already there without permit
MA	Res.-Subd.	inland	20,000 yd^3	yes-mitigation=some wetland left and some added	
MA	road (highway)	?	125,394 yd^3	yes-rec. no discharge/wetland management	4
MA	I/C	?	N/A	EPA/FWS	spec. cond.-creation of wetland
MA	beach rec.	coastal	N/A	N/A	0
MA	drainage	coastal	N/A	N/A	N/A
MA	highway	river/wetland	1,450,000 yd^3 fill	FWS	3 spec. cond.- no miti.
MA	I/C	river/wetland	10,700 yd^3	FWS recom. denial	2
MA	causeway	coastal			6 s.c.

*1981, all states: 1979 and 1980, Massachusetts only-(but Rhode Island processed).

Residential	7
Industrial/Commercial*	11
Road, Highway**	10
Erosion Control	4
Landfill	1
Marina/Recreation	2
Drainage	1

*includes parking for unspecified purposes
**includes one causeway

The vast majority of projects are obviously either roads, industrial/commercial or residential. In at least half the projects, the areas affected were either coastal or riverine; the exact number of vegetated wetland cases could not be determined.

The amount of fill indicates the relative magnitude of the different types of projects. Clearly the highway projects require the largest fills, ranging up to 1,450,000 cubic yards. As expected, the larger the road, the greater the amount of fill. Industrial/commercial filling tended to be smaller, no more than 11,000 yd^3, and residential filling, at least per house, was smaller, if not inconsequential.

None of these projects was denied by the Corps. However, the Fish and Wildlife Service recommended denial at least seven times, and on eight occasions, recommended modification or mitigation. The exact figures are tentative because negotiations with the applicant may cause changes in position. Fish and Wildlife Service objections were often based on the fact that the proposed projects were not water-dependent and could therefore be located elsewhere. EPA recommended denial twice

and modifications and/or mitigation four times, all overlapping with Fish and Wildlife requests. NMFS apparently raised no objections. Recommendations by Corps staff are not explicitly expressed on the Findings of Fact with the opinions of the other agencies because the "FOF" expresses the evaluation of the COE staff responsible for the application.

Special conditions were imposed in the permits in 17, or about one-half, of these cases sampled. Mitigative measures, such as the creation of a wetland or artificial oxbow, were required in 8 cases. In 5 cases, the Corps issued permits with no special conditions in spite of recommendations for denial or modification by the Fish and Wildlife Service or EPA. The NED staff comments that mitigation may be recommended by FWS or EPA but may not always be feasible from an engineering, biological, or economic standpoint. The Corps may decide that public benefit outweighs environmental impact. For example, the Corps may consider an applicant deserving of a permit, even if his project is in an undesirable location, if there is no alternative because the applicant owns no other suitable property for the proposed activity. Recommendations for denial by FWS and EPA were primarily for projects other than roads; roads were recommended for special conditions.

Objections by citizens were noted in only a few of the projects. There were no public hearings held; although one was requested by both the regional planning agency and an environmental group. It is unknown whether the denial of a public hearing was preceded by some negotiated settlement of concerns.

Relations with Other Federal Agencies

1. Within the 404 Process

A. U.S. Fish and Wildlife Service

Relations with the Fish and Wildlife Service regional office in Concord, New Hampshire, are somewhat strained. Basically, Gordon Beckett (Supervisor of Ecological Services) does not feel that the Corps is the best agency to administer wetlands protection programs. His agency, he reports, frequently comments adversely on proposals, but the Corps approves them nonetheless. The Corps states that agency objections are not sufficiently clear or documented to serve as a basis for denial. Mr. Beckett feels that the nationwide permit exemption for headwater areas is a serious loophole and he would prefer that nationwide permits be conditioned on the value of wetlands and a showing of water dependence for the proposed project. The regional permits are less of a problem. He believes that while very large fills are being caught, smaller ones up to 10 acres, are not.

In response to FWS comments NED staff noted the following: "Agency comments rarely make a clear documented case for denial which we can use and which will stand up in court! When USFWS provides a clear description of resources impacted and anticipated impacts we have a basis for denial. When their statements are general and vague we don't have much to get our teeth into."

Regarding controversial proposals to speed up s. 404 processing, Mr. Beckett had no big problem with the speeding up of appeals (requests for review) to 15 days (interoffice memo May 11 to regional directors, FWS). However, the speed-up may cause more, not fewer, appeals; in fact, he states, the Corps sometimes implies to applicants that delays are caused by FWS review. He feels that COE, not the Service, is the cause of any present delays. NED staff respond that Corps delays are often caused by the need to review FWS objections.

Mr. Beckett had no objections to the proposed change which would make NED a District reporting to the Northeast Division in New York. He

objected to the interpretation of "fill" as excluding disposal of solid wastes. He believes applications are steady or rising, especially in coastal areas. He remarked on problems of highway work, sewage treatment plant fills, increased dredging, and landfills. The Fish and Wildlife Service typically seeks mitigation for highways, not route changes. He feels that while state programs may deter applications, typically only the truly determined applicants get as far as the COE permit.

B. National Marine Fisheries Service, NOAA

Chris Mantzaris of the NMFS, by contrast, is opposed to the COE 15-day appeal proposal and thinks that it will be counterproductive. He has no objection to expansion of general permits provided ocean dumping is omitted and docks are built above marshes. He feels that the COE-NED is engineering-centered. He thinks CZM and local permit review have decreased coastal work, but questions whether COE is really catching all the Rhode Island proposals.

In response to NMFS comment that COE-NED is engineering-centered, NED points out that the Regulatory Branch has 3 biologists, 1 ecologist, 1 physical scientist, 2 regional planners, and 2 geologists.

C. Environmental Protection Agency

EPA personnel objected to the scope of the present nationwide 5-cfs permit exemption, and estimated that increasing it as proposed in new COE regulations published July 22, 1982 would result in exempting 80 percent of New England wetlands, or even more. Again, general permits at the present level were not seen as a problem. Another major objection was the centralization of the appeal ("elevation") process, whereby review could be gained only upon the recommendation of the Administrator or Deputy Administrator of EPA, Assistant Secretary of the Interior for Fish and Wildlife, or Administrator of NOAA. This is administratively impossible and will kill the deterrent effect of the

potential EPA veto (only once employed, in Florida) under 404(q). EPA's function is to add its environmental expertise. This would be better carried out, in the opinion of some staff, by more frequent use of the veto.

Recommendations for dealing with the problem of the headwaters permit exemption were that there should be a threshold limitation on size of the proposed fill so exempted; yet there is currently no serious consideration being given to rational changes in the program; only to increasing exemptions and making appeals difficult.

In regard to the nationwide 5 cfs permit exemption, NED states that no specific activities so covered in the past 5 years have been brought to the Corps' attention showing this to be causing adverse impacts.

2. Related Federal Agencies

A. Federal Emergency Management Agency

FEMA regional acting director Ed Thomas reports that no estimate has ever been made of the impact of the flood insurance program on wetlands protection. Although he estimates that as much as 95 percent of wetlands in New England are related to surface water floodplains, he notes that FEMA maps do not include headwaters and adjacent wetlands (similar to COE nationwide permit exemptions). Effects of the program are difficult to estimate because of the following:

a. The program does not generally forbid development outright, except in riverine floodways and some barrier beach areas. Instead it imposes building standards to withstand flooding. Floodways are impossible to calculate in north-flowing glaciated river valleys common in New England, so the prohibition is not being imposed there.

b. The FIA permit process is handled through, and by, local regulatory bodies in thousands of communities which have joined the program. Some regulate much more stringently than FIA requires. Others try to avoid even the minimal requirements.

B. Coastal Zone Management program

Federal CZM personnel were not consulted for this project. Massachusetts and Rhode Island CZM people have no doubt that application of funds, expertise, local aid, and review through the CZM program applied at the state level have all improved protection of coastal wetlands. Other state agencies generally concur. However, there is no clear contact between CZM and COE, procedurally or otherwise. Gary Clayton of Massachusetts CZM reported only case by case contact, usually on dredging projects. He would use COE where a "bad" local decision (in his view) is not appealed. He pointed out that the COE involvement is a "handle" for the NEPA review and for CZM certification of "federal consistency". Without these handles, locally approved work will not have further federal review no matter how damaging it is.

CONCLUSIONS REGARDING FEDERAL AND STATE WETLANDS PROGRAMS IN NEW ENGLAND

It is clear from the above analysis that data are not sufficient to permit us to state with confidence exactly how well the state programs and s. 404 are protecting wetlands in New England. However, certain conclusions emerge quite clearly. Among them are the following:

Permit Program Generally

1. Mere existence of state and federal wetlands protection laws is beneficial in protecting wetlands because it encourages redesign or abandonment of destructive projects and because it raises public consciousness of wetlands values.
2. In all New England states except Vermont and inland Maine, programs administered by state and local agencies provide permit procedures to regulate, if not prevent, filling and other actions destructive of vegetated wetlands.
3. But there is little consistency among the New England states, whose programs vary according to locality, legal loopholes like exemptions, differing local and state views, and budgetary constraints.
4. In general, however, most programs emphasize conditioning of permits to minimize damage rather than to simply accept or reject applications for permits.
5. The major exception to this is coastal wetlands, where, due to such factors as CZM programs and better funding, tougher state regulations, maturing public attitudes, and possibly decreasing development pressures, tidal salt marshes are apparently not being filled in recent years.
6. The visible benefits of CZM review in coastal areas show that all

programs, whether locally or state run, benefit from a careful scientific review of each project. (Note that this review is apparently helpful even though not accompanied by any new legal powers of enforcement.)

7. As expected, the number of outright denials in inland wetlands is small and appears to depend heavily on project size or controversiality rather than on true wetland value issues (although size of project obviously influences the scope of the impact). Denials are most frequent in Massachusetts and Connecticut; but in no case exceeded 4 percent in 1981 of the permits requiring formal review (themselves a small percentage of overall permit applications).

8. Although the Corps of Engineers, by policy, denies projects which have been denied by any state, it was difficult to find evidence of independent denials by the Corps itself. The Fish and Wildlife Service stated that only one COE denial was issued prior to 1982 in the New England Division (apparently a case in Milford, Connecticut). The Corps estimated that 1 to 2 denials per year were issued, some of which may subsequently have been denied by states. All Corps permits granted before state permit action are made expressly contingent on state approval. According to Corps regulations (July 22, 1982) a permit can be issued if the state delay is more than three months but is invalid without eventual state approval.

9. From the point of view of protecting wetlands, it would appear that the COE leaves the burden of denying projects on the states. The NED states that this is true only when national issues are not involved, and points out that by regulation they must otherwise accept state and local decisions. But the states each have their own jurisdictional capabilities and political pressures (and in Vermont and inland Maine, this is obviously inadequate).

10. The relative funding situations of the COE and the states is difficult to assess because the budgets are often not broken down for specific programs; a lack of resources is a unanimous complaint.

11. Physical data are still poor. The data from the recent FWS mapping should be made available quickly so we can get good figures on actual wetlands acreage.

12. The FWS classification and the University of Massachusetts model for wetlands of highest value should be made use of as an extra protection (for example, in declaring an "Area of Critical Environmental Concern" under the Massachusetts MEPA law) with careful attention to prevent its being used as an excuse for sacrificing wetlands which are not prime.

Projects of Particular Impact

13. The role of exemptions in all programs deserves more attention than it has received. Agricultural activities are excluded from s. 404 requirements and from those of many state wetlands programs. State officials and the Corps are not troubled by this exemption so long as it is limited to normal work in land in agricultural use. However, the Organ study (see Economic Development report) shows that in Massachusetts "impoundment" of water has affected 461 acres of wetlands in 15 towns over the study period--a very large number of acres compared with the other figures in the study. Although these 461 acres of impoundment are listed as "wetlands gained", there is reason to believe that they represent in fact a change from shallow to deep water wetlands (his study shows a man-caused loss of 1,143 acres of shallow wetland). The impact of this shift has not been studied.

Although many of the impoundments are farm ponds, others are (probably increasingly) recreational ponds. This accords with data from Rhode Island and New Hampshire (see state Legal-Institutional reports) showing a very large percent of permits are for domestic recreation and small ponds. In the lower, tidal reaches of the Connecticut River, many wetlands have been displaced for boat basins. This kind of use is often permitted even under the stricter state laws, and "water-dependent" uses are encouraged in the Coastal Zones under approved CZM plans. It can,

of course, be argued that many of the pond areas were in the past deep-water wetlands recently succeeded by shallow wetlands. However, the cumulative impact on wetlands of creating ponds and impoundments is slipping through the cracks of existing regulatory laws in New England.

Other agricultural/silvicultural activities which are exempt from federal and most state law are also dismissed as nondamaging to wetlands by state and federal officials, but this is dubious in areas of high activity (see Economic Development study). Whether enlarging regional permits for roads, docks, and water conservation would weaken the program is debated by the state officials. In any case, local environmental groups object to the proposal to enlarge the COE road exemption due to long-standing difficulties with the nature and extent of highway works.* Clearly the lack of exemptions and the clarity of jurisdiction in the coastal areas has reduced confusion and contributed to the success of that part of the program. Exemptions in state programs, such as small swamps and marshes in Rhode Island and the noncoverage of wildlife in Massachusetts, are also difficult to assess due to lack of data and problems with measuring impacts.

The most serious COE exemption by far is the "nationwide" permit (really a qualified exemption) for activities on wetlands which are headwaters with flows of less than 5 cfs. Fish and Wildlife and EPA personnel both objected to this exemption as not authorized by the statutory provision for activities of "similar nature". An informal EPA study of two quadrants of Vermont land indicated that the present 5 cfs standard exempts 40 percent of all wetlands. COE Regulations published July 22, 1982 would exempt up to 85 percent. They agree that if COE jurisdiction has to be cut back, it would make more sense to limit it to

*See COE Regulations published July 22, 1982.

major activities, to projects impacting large areas of wetlands, and/or to activities impacting wetlands of designated high quality (see Rhode Island approach). None of these approaches is being discussed in the controversy over 404. NED staff note that FWS and EPA have produced no data to support objections to the 5 cfs standard.

14. According to physical data, road building and road work are principal sources of wetland loss in Massachusetts (see Organ study, Bristol County study, Cummingham study, and Table TL-1, showing transportation as the largest increase in use during the study period). This is in general accord with Massachusetts WPA permit data and MEPA analysis (see Legal/Institutional). Data from other states is less certain; but roads represented over a quarter of all the freshwater wetlands permits considered by the Rhode Island FWWS in 1980 (see Table in Rhode Island Legal/Institutional Report). (These numbers are not restricted to work in vegetated wetlands.) The data are compatible with the "can't beat city hall" attitude of almost all state wetlands program officials regarding the uselessness of opposing road building in wetlands, especially where big state highway projects are involved. If road building cannot be made more responsive to environmental issues at the planning stage, then states should at least develop more rigorous mitigation measures, such as those which the COE sometimes requires, e.g., replacement of lost wildlife habitat with more than equal amounts of habitat of equal quality.

A major law suit is in progress concerning completion of I-25 in Bourne, Mass. Although the Grazing Fields Farm case is legally focused on the NEPA process, it factually concerns a proposal to build a slightly

longer route in order to protect wetlands, a working farm and a wildlife refuge. State and federal highway officials oppose the longer route on the grounds of expense and safety. There appears to be no improvement in highway design except perhaps the DOT Regulation published June 10, 1982, dropping the over-engineered federal AASHTO design standards on projects which fund repair of existing roads. This was done to spread the money around, but could help the environment.

Unexamined Effects

15. The correlation between project type and acreage of wetland altered could not be determined from the level of permit investigation performed for this project. Clearly some projects, such as construction of a highway within a town have the potential to affect a greater area of wetland than the repair of a culvert, but each would have a single permit.

Similarly, issues of wetland value were not directly addressed in this study. An apparently insignificant project as it appears in a permit could affect a hydrologically, aesthetically, or ecologically more important wetland than a large project in a less sensitive or pressured area. Opinions of agency staff vary on the question of cumulative impacts. Since most activity in New England wetlands is small-scale, the net result could be substantial in terms of acreage.

Because of the differences in types of wetland and consequent susceptibility to adverse impacts, it cannot be determined what types of human activity (drain, excavate, fill, etc.) are categorically most damaging.

16. Cumulativity of effects of wetlands work could not be determined through this study. Clearly, if Massachusetts will lose .4 percent of

its wetlands annually through 1990 as predicted by SCS (see Physical Data report), the cumulative effects will be great. (This would amount to at least 1,600 acres lost annually, mostly in small permitted projects involving less than an acre of fill, and equally small violations.) Yet small actions are readily given permits--and small violations often ignored--because the public, and officials, ignore cumulative effects.

17. The physical data shows that in Massachusetts (and probably throughout New England), wetlands destruction has been in part counterbalanced by successional changes resulting from abandonment of farmland. This counterbalance may have led to complacency and the feeling that wetlands loss has not led to any bad effects and should be allowed to continue. The public should be made aware that the "bailout" cannot possibly continue as major farm abandonment is now almost complete and silviculture is now on the rise in New England.

18. None of the data discussed touched on the issue of wetlands degradation: whether work near or in wetlands has lessened their value; whether the new wetlands we are gaining are comparable to those we are losing. This must be studied before final conclusions are drawn.

COE Program

19. The major COE contributions to the state programs may be summarized as follows:

    a. The Corps appears more inclined to force violators, including those who have acted without the required permit, to restore an area, remove fill, or otherwise remedy the damage.

    b. The 404 program provides wetlands regulations in areas (like Vermont and inland Maine) not adequately covered by state

programs. In addition, 404 extends consideration to values not included by states, such as wildlife interests in Massachusetts.

c. The mitigation policy specifying creation of wetlands, replacement of habitat areas, and other compensatory provisions is more advanced in the federal program than at the state level.

d. Although inclined toward the structural solution, Corps personnel have expertise in engineering, coastal resources, hydrology, and flood control.

e. Because all coastal tidal marshes are included, regardless of size or location, COE jurisdiction helps to protect coastal areas (where the Corps had already acquired familiarity with regulatory work prior to s. 404).

f. The Corps program offers an additional level of review providing a safeguard against undesirable projects which are approved by the states. Environmental groups, and, on occasion, the staff of state agencies particularly appreciate this potential.

20. A major problem with the COE program is the lack of public awareness and of coordination with state agencies. Rather than advertise its availability or emphasize controlling major projects, the COE appears to prefer to deal with whatever complaints, inquiries, and applications come its way (although NED staff report extensive public information programs on 404). The amount of enforcement is unclear; limited staff time is spend on aerial surveys (one overflight per week) and other inspection of permitted or illegal activities. Only Maine and Connecticut have some joint public review. Otherwise, the states seldom do more than vaguely tell applicants for state permits that a COE permit may be necessary; some of the warnings are better calculated to scare people off from the

COE than to entice them to apply (see Rhode Island pamphlet).

Connecticut and Maine coastal programs have a level of COE activity very high compared with state coastal activity reported in those states. Since these two states come the closest to joint processing, we tentatively conclude that any kind of joint permit will raise public consciousness and give the COE more information.

21. Clearly, the public information problem is exacerbated by the tendency of the COE to run totally insulated and separated data systems, divided not even by state, and the staff having responsibility over bits of different states; thus it can be an exercise in frustration to find out whether a particular matter was in fact processed by the COE. Clearly, cross referencing of files is a prerequisite to COE coordination with state programs, and NED staff report that they are currently reorganizing their data systems by state and that computer access to specific projects is good.

22. Regarding the time needed for the process of obtaining a permit, delays by the COE were frequently mentioned. Fish and Wildlife stated that the wait was not attributable to joint federal agency review; COE staff indicated problems with obtaining adequate information from the applicants, delays with other permits, and manpower shortages.

23. If COE jurisdiction must be cut back, the Corps should concentrate on projects involving large amounts of wetlands work and/or projects in most sensitive wetlands (derived by work on FWS classification data), not on location of wetlands as exemplified by the 5 cfs exemption, which is purely historical in origin and acknowledged to be unrelated to wetlands value. Furthermore, this exemption is not justified in federal law, which allows exemptions only for similar activities. The new COE Regulations, increasing this exemption so as to exempt almost all inland wetlands--those most

in need of protection--has been made possible partly by public ignorance and state officials' resistence to the CCE program.

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MASSACHUSETTS APPENDIX

PART II APPENDIX

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PART III

EVALUATION OF ECONOMIC FACTORS AFFECTING WETLAND TRENDS IN NEW ENGLAND

by

Thomas H. Stevens

Evaluation of Economic Factors Affecting Wetland Trends in New England

I. Massachusetts

Between 1951 and 1971, population increased 21 percent, agricultural acreage decreased 35 percent, and residential acreage increased 85 percent within the state of Massachusetts (see Table TL-1). During this period, the distribution of wetland type also changed significantly. Open wetlands increased by 31,461 acres (18% increase), while shallow fresh water wetlands decreased by 24,125 acres (21% decrease). Forested wetlands are excluded from these data. The greatest gain in open wetland acreage occurred in Berkshire, Bristol, Essex, Middlesex, Plymouth and Worcester counties, while the greatest loss in shallow fresh water wetland occurred in Bristol, Essex, Hampden, Middlesex, Norfolk and Worcester counties (see Tables TL-2 to TL-15). Total wetland acreage increased in 7 counties and decreased in 7 counties with the largest net loss occurring in Worcester county (5,841 acres).

From a policy perspective the decline in shallow water wetland is of particular concern. Although relatively little wetland acreage was lost in total, this is largely because gains in open wetland acreage offset losses in shallow water wetland. The "open" category consists of rivers, reservoirs, etc. which are not of primary concern in this study. Significant loss did occur in the shallow wetland category and the average population growth rate within the counties losing most of the shallow wetland was 30 percent. This compares to a 21 percent population growth for the state as a whole (1951-1971). Consequently a correlation likely exists between population, associated economic activity and loss of shallow fresh water wetland in Massachusetts. For example,

transportation acreage increased by 418 percent in the counties losing the most shallow fresh water wetland. This compares with the state wide average increase of 319%. Moreover, the counties losing most of the shallow wetland contained over 60 percent of the total state's population in 1971.

To further examine the influence of economic factors on wetland trends, data for 15 representative towns and all coastal zone areas in Massachusetts were examined.

Coastal zone wetland trends (McConnell) for the 1951-1971 period are reported in Tables CZM-1 through CZM-9. Taken together, total wetland acreage within the Massachusetts coastal zone decreased by 2,051 acres. The coastal zone data presented in Tables CZM-1 through CZM-9 are summarized below:

Table 20. Summary of Gains and Losses of Wetlands on the Coastal Zone

Cause	Gain (acres)	Loss (acres)	Net Change (acres)
Residential		318	-318
Public		17	-17
Commercial		102	-102
Industrial		96	-96
Transportation		528	-528
Mining	8	234	-226
Recreation		339	-339
Agriculture	1,215	579	+636
Forests	6	1,067	-1,061
Total	1,229	3,280	-2,051

This information indicates that transportation, agriculture and forests accounted for much of the net change in wetland acreage. 528 wetland acres were lost to transportation and 1,067 acres were lost to forest. Although there was a 636 acre net wetland gain associated with agricultural activity, 1,215 wetland acres were gained and 579 acres were lost. Most of the gain occurred in Barnstable County (Cape Cod), and if this county is excluded, there was a 162 acre net loss of wetland due to agriculture. In fact, 67 percent of the wetland loss due to residential activity; 64 percent of the loss due to forests, and 55 percent of the loss due to recreation development occurred in Barnstable County. Barnstable County also experienced the most population growth (on a percentage basis), the largest decline in forested acreage, the largest decline in agricultural acreage, and the largest increase in acreage devoted to recreation. Consequently, a relationship appears to exist between economic activity and wetland change on the coastal zone.

On a percentage basis significant wetland loss occurred within the coastal zone--5 percent of the total wetland acreage was lost, and agriculture, transportation and forests are likely to be the greatest economic agents influencing future wetland trends within the coastal zone. For example, cranberry bogs are classified as agricultural land, but when cranberry production is discontinued, the bogs are classified as wetland. In addition, farmland abandonment can result in an increase in wetland acreage since drainage ditches, etc. are no longer maintained.

Within the coastal zone, agriculture declined by 17,686 acres (see Tables CZM-1 to CZM-9). This decline appears to be associated with the creation of 636 acres of wetlands. It is, therefore, important to

briefly examine the economic factors influencing agricultural production on the coastal zone.

Massachusetts is the nations largest cranberry producer. However, between 1959 and 1978, over 1,600 acres of cranberry bogs were abandoned or shifted to other users. Although the industry is still economically strong, Wisconsin's (a major competitor) yield per acre is much higher and farm wage rates are also lower in Wisconsin. Consequently, cranberry acreage in Massachusetts is likely to remain stable or decline slightly within the foreseeable future.

Other types of agricultural acreage in Massachusetts and in the coastal zone have, however, declined substantially in recent decades. This is due to several factors. First, the competitive position of Massachusetts agriculture is constrained by the high price of land in Massachusetts relative to other areas of the nation. This results in small farm size which contributes to the low net farm income generated within the state. Second, agricultural chemicals, fuels and feed grains are generally more expensive in Massachusetts than elsewhere. As a result of these factors, agricultural acreage within the state declined by 35 percent over the 1951-1971 period (see Table TL-1). This decline, which is likely to continue in the future, is partly responsible for the apparent relatively low net loss of wetland acreage within the state.

Unfortunately, there are several problems with the wetland trend data reported above. First, the state and county land use summaries (Tables TL-1 to TL-15) exclude forested wetland. Second, the state and county data are judged to be accurate in terms of total land use patterns, but the wetland acreage was measured with relatively less accuracy.

Because of these problems, the relationship between economic factors and wetland trends tend to be obscured.

Some of the most reliable wetland data is available for Bristol County, Massachusetts (Larson, Mueller, and MacConnell), and for 15 representative towns studied by Organ. The results of the Bristol County study are summarized by Larson, Mueller and MacConnell as follows:

> Sixteen man-induced causes of wetland change were identified, in addition to natural succession. Table 1 reports losses, gains and net change attributed to each cause where known.

TABLE 1. Man-caused and natural successional changes in open freshwater wetlands (ha)

Cause	Total changed	Losses*	Wetland-wetland†	Gains‡	Net change
Agriculture	82·9	20·4	45·7	16·7	−3·7
Cranberry bog culture	82·9	0·2	47·3	35·4	+35·2
Dump	34·9	24·8	7·8	2·2	−22·6
Filter bed	4·6	0·0	0·8	3·8	+3·8
Recreation	6·8	3·0	3·4	0·4	−2·6
Golf course	27·5	22·8	2·6	2·0	−20·8
Highways and roads	84·5	29·7	36·2	18·6	−11·1
Sand and gravel pit	27·7	2·0	8·9	16·7	+14·7
Industry	26·2	20·0	1·2	5·0	−15·0
Commercial business	10·7	7·2	3·4	0·0	−7·2
Residential	22·4	20·8	1·6	0·0	−20·8
Public buildings	3·4	3·4	0·0	0·0	−3·4
Powerline	4·8	0·0	4·8	0·0	0·0
Municipal reservoir	56·4	25·4	11·3	19·6	−5·8
Other impoundments	46·7	10·9	11·1	24·6	+13·7
Unclassified	37·6	23·0	14·5	0·0	−23·0
Man-caused subtotal	560·0	213·6	200·6	145·0	−68·6
Unknown cause	46·1	2·4	43·6	0·0	−2·4
Natural succession	1485·2	0·2	1448·2	36·8	+36·6
Total	2091·3	216·2	1692·4	181·8	−34·4

* Changes from a wetland class to dry land by filling or draining.
† Changes from one wetland class to another, including open wetland created from wooded wetland.

Agriculture created wetlands through pond construction and by creation of seepage meadows below pond outlets. Drainage and channelization resulted in wetland loss by poor maintenance frequently resulted in reversion to predrainage status. Grazing appeared to be an important factor in maintaining the meadow wetland class. Cranberry bog culture was

the single most important source of man-induced wetland gain. Most loss due to dumps occurred in a single location and a single instance of wetland gain occurred from partial filling of open water with effluent from a sewage treatment filter bed. Recreational changes were mainly due to creation of new swimming areas or removal of aquatic vegetation to facilitate boating or swimming. While golf course construction included the creation of small lakes and ponds, the net effect was a substantial loss of wetland area.

Highway and road construction was the single largest source of wetland change. Sand and gravel pit construction created more wetland than was destroyed, mainly by creation of water-filled depressions, sedimentation and damming stream flow. Construction of industrial, commercial business and residential sites rarely created wetlands and as a group these were important sources of wetland loss. School construction accounted for all the change due to public buildings while powerline construction had no effect on wetland gains or losses. Municipal reservoir management and construction caused substantial changes in wetland class but little net area change. Building and destruction of dam changes in water level and location of new overflow pipes were the major activities responsible for wetland change around reservoirs. Intentional or accidental destruction of other dams caused most of the change in the other impoundments category, because open water types behind dams often reverted to vegetated wetland following dam destruction. The unclassified category includes areas where man's activities were abandoned or incomplete and not assignable to a specific activity. The unknown category represents unexplained death of tree, shrub and aquatic plant communities that created new open water.

Succession was deemed to be the responsible agent of change in areas where woody vegetation in wetlands had grown to trees (defined as over 6 m high), where woody shrub invaded previously open wetland areas, where floating or submerged vegetation had become established in open water or, one instance of natural migration of a sand dune into a marsh. Succession affected more area than all other causes combined.

The overall conclusions of this study are reported by Larson et al. as follows:

(1) Natural succession and man-induced changes in open freshwater wetlands were measured over a 20-yr. period using panchromatic aerial photographs. Over the period 1951-71 nearly one-half of 3958-9 ha of these wetlands showed a change in vegetation class.

(2) Change in wetland vegetation class due to natural succession exceeded all man-induced changes. Agriculture, cranberry culture and highway construction were the leading man-induced causes of wetland change.

From the evidence presented by Larson et al., agriculture and transportation are, therefore, likely to be the major economic activities influencing wetland trends.

A study by Cunningham also supports this finding. Cunningham analyzed wetland trends (1951-1971) for the tidal wetlands of Southeastern Massachusetts. Nineteen towns were included in the analysis and 107.4 ha of wetland were lost during the 1951-1971 period. Losses due to economic activity were 128.7 ha, 19.9 ha were gained due to economic factors, and natural losses balanced natural gains. Road construction

was the largest cause of man-induced wetland loss. According to Cunningham, "If artificial succession, primarily an indirect effect of road construction, is included, the activity is two-fold any other man caused loss."

The 15 towns studied by Organ included both coastal and non-coastal zone areas. Between 1951 and 1975/77 a total of 436 acres of wetland were lost in these 15 towns. (This represents a loss of approximately 1.2 percent of the 1951 wetland base.) Population change was greater within the 15 town study area than in the state as a whole, while the population density (per square mile) was less in the study area than that for the state as a whole.

As before, the Organ data indicates an overall gain in open wetland through impoundment, etc. and a loss in shallow wetland acreage. If the open category is excluded, within the 15 towns 1318 acres of wetland were lost (4.4%). If natural causes are also excluded from consideration, 1,143 acres of shallow wetland were lost due to man caused activity (4.9% of total).

Organ's data also shows that more shallow wetland was lost in the inland towns than in the coastal towns. If natural causes are excluded, 437 acres (3.1%) of shallow wetland were lost in the coastal towns while 706 acres (6.5%) of shallow wetland were lost within the inland towns studied.

The principle cause of loss or gain of wetland may be summaried as follows:

(A) When all wetlands and all 15 towns are considered together, 456 acres of open wetland were added due to impoundment, 185 acres of

wetland were lost due to residential building, 244 acres were lost to industrial and commercial development, 262 acres were lost to highway and airfield construction, and 76 acres were filled for unknown causes. Overall 897 acres were lost and 461 acres were gained--resulting in the net loss of 436 acres reported above. Almost all of the gain was due to impoundment (open water), while 30 percent of the loss was due to transportation, 21 percent of the loss was due to residential development and 27 percent of the loss was due to commercial and industrial activity.

(B) When consideration is limited to changes in wetland covered by the 404 process, 32 percent of the change in wetland was due to impoundment, 12 percent due to highway construction, 11 percent due to industrial and commercial development, 17 percent due to agriculture, and 9 percent due to residential development. In terms of losses and gains, 455 wetland acres were gained by impoundment. However, this gain is a shift in wetland type from wetlands covered by the 404 program, to the open water category which is not regulated. Losses due to highway, residential, etc. were similar in magnitude to those reported in (A) above.

In general, the data for the 15 towns studied by Organ reveals that impoundment is the major factor affecting man caused wetland change. As before, highway construction is a major cause of wetland loss, but losses due to industrial, commercial, and residential development were all quite significant.[1/]

[1/] Within the 15 towns combined, population increased 95 percent, forested acreage declined 6 percent, agricultural acreage declined 22 percent, residential acreage increased 108 percent and transportation acreage increased 303 percent. Forested acreage declined by 12,096 acres, agricultural acreage declined by 13,123 acres, residential acreage increased by 17,403 acres and transportation as a land use increased by 2,054 acres (see Tables 0-1 to 0-15).

Another way to examine the relationship, if any, between economic factors and wetland trends is to examine the number of wetland permits processed over time. As noted by Dawson, the total number of permits processed in Massachusetts steadily rose from 1973 to 1979. However, in 1980-82, the number of permits processed fell. This pattern is also evident in Rhode Island.

Total wetland permits processed in Massachusetts are compared to single unit housing permits and value of total construction contracts awarded below: Table 21. Wetland Permits and Construction Value in MA 1975-1981

Year	Wetland* Permits Processed	Single Unit Housing Permits Awarded**	Value of Total Construction Contracts***
1975	1422	933	--
1976	1845	1237	102.1
1977	--	1518	125.3
1978	2953	1096	153.1
1979	3010	996	181.6
1980	--	840	184.0
1981	2747	--	--

*Source, Dawson. Note that 1978, 1979 and 1981 are for fiscal year.

**Source, Federal Reserve Bank of Boston, Economic Indicators. Data are for calendar year (annual average of monthly activity; seasonally adjusted).

***Source, Federal Reserve Bank of Boston, Economic Indicators (index 1967=100; seasonally adjusted annual average).

As shown above, single housing permits increased from 1975 to 1977 but fell from 1978 to 1980. In 1981-82, single family housing construction activity continued to decline due to the effects of the 1981-82 recession. However, value of total construction contracts (index) continued to rise over the 1976-1980 period (It is not clear whether the effects of inflation have been included or excluded from this index.).

From the information reported above it may be concluded that some relationship exists between building activity and pressure to develop wetland. However, no definitive conclusions can be reached because good data on wetland permit activity is not available prior to the early to mid 1970's. Consequently, the data available is of insufficient duration to allow a clear relationship between construction activity and pressure to develop wetland to be derived.

Regression analysis was also utilized to investigate the relationship between wetland change and economic factors. Several relationships were examined as follows:

(1) The county data (Tables TL-2 to TL-15) were used in the regression model:

$$W = \alpha + B_1P + B_2A + B_3T + B_4RCI$$

where W is the percentage change in shallow fresh water wetland (1951-1971), P is percentage change in population, A is percentage change in agricultural acreage, T is percentage change in transportation acreage, and RCI is the percentage change in residential, commercial, and industrial acreage averaged together. The results using OLS were:

$$\underset{}{W} = \underset{(1.02)}{-54.1} + \underset{(.046)}{.02P} - \underset{(.72)}{.75A} + \underset{(.02)}{.005T} + \underset{(1.03)}{.17RCI}.$$

$R^2 = .23$ and numbers in parentheses are "t" statistics.

These results fail to indicate a statistically significant relationship. Multicollinearity was, however, present and the model was reestimated using stepwise regression. As before, no significant relationship was found.

(2) The county data were also utilized to examine the relationship between percentage change in shallow fresh water wetland and the 1971 population density (person's per acre). The results were:

$$W = -12.38 - 18.98 \text{ Ln PSQ}$$
$$\quad (1.67) \quad (2.60)$$

$$R^2 = .36$$

where PSQ is population per acre in log form and the numbers in parentheses are the absolute value of the "t" statistics.

These results indicate that as population density increases, wetland change goes from positive to negative. Thus, high density areas are associated with a negative change in wetland (a loss). That is, as PSQ becomes larger, the percentage change in wetland can become negative (a loss), and with increasing density, the wetland loss becomes greater on a percentage basis (the PSQ coefficient was statistically significant at the 95 percent level). This simple model indicates that wetland change is related to population density, and as the economy becomes more urban in nature, more shallow fresh water wetland is likely to be lost. Moreover, the relationship appears to be exponential in nature since the linear form of this model was not statistically significant. However, only thirty-six percent of the variation in the change in wetland was explained by this model. Due to the lack of comprehensive data, it is difficult to come to any policy relevant quantitative relationship between economic activity and wetland change.

II. Rhode Island

Golet's study of wetland trends in one southern Rhode Island town (1939-1972), reveals that "...changes in wetland brought about by natural succession overshadow the active impact that man has had...during the

past 35-40 years." As in Massachusetts, highway construction accounted for much of wetland loss, and the abandonment of agriculture contributed significantly to changes in wetland type.

III. Summary

The influence of economic factors on wetland trends over the 1951 to 1971 period can be tentatively summarized as follows:

1. Although the net wetland loss in Massachusetts was small, substantial shifts in wetland type occurred. Shallow fresh water wetlands decreased while open wetlands increased. This change may be associated with economic activities, but the data base currently available is not sufficiently robust for detailed analysis of such shifts in wetland type on a statewide basis.
2. Significant wetland loss has occurred within the coastal zone. Of this loss, 25 percent was due to transportation, 10 percent was lost due to commercial and industrial activity, 13 percent was lost due to mining, 17 percent was lost due to recreational development and 53 percent was lost due to change in forest lands. However, agricultural activity resulted in increased wetland acreage, and the projected decline in agricultural acreage throughout the state may be an important factor affecting future wetland trends.
3. In general transportation, forests, and agriculture appear to be the greatest economic factors responsible for wetland change. However, changes in wetland type due to natural succession tend to exceed man induced changes.
4. Analysis of 15 representative Massachusetts towns reveals that impoundment is also a major cause of wetland change.

5. Regression analysis indicates that as population density increases, loss of shallow fresh water wetland increases at an exponential rate. Although this indicates that economic forces do affect wetland trends, it was not possible to statistically isolate the separate effects of housing, industrial development, etc.

In general, the situation in Massachusetts (and throughout New England) appears to be characterized by development pressure on wetland from a variety of sources -- no single economic factor emerges as the driving force behind wetland development. Rather the pressure to develop wetland appears to arise from a variety of sources. Better data on wetland change and the causal factors responsible are needed before the specific economic forces involved can be isolated.

Impact of Changes in Use of Wetlands on the Economic Base

Land is an important factor of economic production and legislation restricting wetland use can, in theory, effect the overall level of economic output. That is, wetland restriction reduces the land area available for development and as a result all land prices may be higher than they would have been otherwise. This may stimulate industry, etc. to locate in areas where restrictions are less severe. Alternatively, capital and/or labor may be substituted for land at a higher cost. In any event, given a competitive land market the market sale price of

wetland equals the net development value of wetland. This value is foregone if wetland legislation restricts development. On the other hand, wetlands in their natural state provide a variety of non-market services such as water supply, flood protection, scenic vistas, wildlife, etc. Consequently, the net economic effect of wetland restriction is the difference between net development value foregone and the value of the non-market services which are preserved.

If the land market is competitive, then the market price of wetland including the cost of fill should equal the value of dry land, ceteris paribus. To illustrate, assume that dry land sells for $500 per acre in a competitive market. Further assume an adjacent wetland (identical in all respects except for the water) which can be converted to dry land at a cost of $100. In this case, the wetland should sell for $400. The net development value of the wetland is $400 (this is the net value foregone by wetland restriction), while the net development value of dry land is $500. The $100 differential represents the cost of fill, which includes labor, material, etc. which could be employed elsewhere in the economic system.

To evaluate the effect of wetland restriction upon the economic base two sets of information are therefore required:

1) Market price of wetland which should equal net development value foregone in a competitive economy.
2) Value of non-market services produced by wetland in their natural state.

At the margin, and assuming a competitive economy, the market price of wetland equals the value of non-market services produced by wetland

in its natural state. For example, assume that dry land sells for $500/acre. This amount represents the capitalized value of the annual flow of economic output that can be obtained from the dry land. A wetland which is identical in all other respects should sell for $400 if the cost of fill equals $100. Moreover, the $400 wetland price should equal the payment or sacrifice people are willing to make for the non-market services produced by the wetland in its natural state. However, since non-market services cannot be captured by private owners, the value of the non-market services will not be observed in the private market.

The logic outlined above was used in Gupta and Foster's 1975 study of Massachusetts wetlands as follows:

1) The market price of wetlands sold in Massachusetts in 1970-71 varied from a negligible value in rural areas to $70,000 per acre near Boston. Using a 5.375% capitalization rate, the annual net development value lost from wetland preservation ranged from $3,762 to $16 per acre in urban areas.

2) The value of wetland preservation was estimated by examining the price of wetlands which were purchased by conservation, fish and wildlife and other groups for the purpose of preservation. These prices ranged from $59,900 per acre to $700 per acre depending upon the natural productivity of the wetland.[1/]

If the annual net development value is less than the value of wetland preservation, then the wetland should be preserved. The analysis by Gupta and Foster suggested that over 90% of the wetlands in the state should be preserved according to this criterion. Consequently, continued wetland restriction is advocated as a means of increasing the overall economic welfare of the state.

1/ Source: T. R. Gupta and J. H. Foster, "Economic Criteria for Freshwater Wetland Policy in Massachusetts," Am. J. of Agr. Econ., Vol. 57, No. 1, Feb. 1975.

TABLES TL-1 to TL-15

TOWN LAND USE AND ECONOMIC ACTIVITY SUMMARY
BY STATE AND COUNTIES, 1951-1971*

*Source: MacConnell, Remote Sensing Data
Note: 1951 data excludes mining. 1951 and 1951 data exclude wooded wetlands
All tabular data compiled by Denise Emmons.

TABLE TL-1
MASSACHUSETTS TOTAL LAND USE SUMMARY

Land Area Total: 5,199,254 acres

	1950	1970	Change
Population	4,690,514	5,689,170	21%

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	3,364,977	65	3,272,302	63	-92,675	-3	-2
Agricultural	1,052,643	20	686,733	14	-365,510	-35	-6
Indust./Commerc.	37,590	1	75,806	2	38,216	102	1
Residential	315,588	6	584,314	11	268,726	85	5
Transportation	12,844	--	53,869	1	41,025	319	1
Public & Open	53,041	1	68,927	1	15,886	30	--
Mining & Waste			34,217	1			
WETLANDS:							
Open	174,298	3	205,759	4	31,461	18	1
Fresh	135,840	3	113,126	2	-22,714	-17	--
Salt	52,433	1	43,280	1	-9,153	-17	--
TOTAL WETLANDS	362,571	7	362,165	7	-406	--	--

TABLE TL-2
LAND USE IN BARNSTABLE COUNTY

Land Area Total: 280,307 acres

	1950	1970	Change
Population	16,805	96,036	107%

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	173,895	62	153,742	55	-20,153	-12	-7
Agricultural	42,257	15	22,754	8	-19,503	-46	-6
Indust./Commerc.	491	--	2,711	1	2,220	452	1
Residential	15,220	5	39,207	14	23,987	158	9
Transportation	865	--	3,455	1	2,590	299	1
Public & Open	2,514	1	3,319	1	804	32	--
Mining & Waste			1,659	--			
WETLANDS:							
Open	25,176	9	26,952	10	1,776	7	1
Fresh	3,747	1	7,098	2	3,351	84	1
Salt	16,142	6	13,184	5	-2,958	-18	-1
TOTAL WETLANDS	45,065	16	47,234	17	2,169	5	1

TABLE TL-3
LAND USE IN BERKSHIRE COUNTY

Land Area Total: 604,977 acres

Population:	1950	1970	Change
	132,966	149,402	+12%

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	442,761	74	444,583	74	1,822	--	--
Agricultural	126,453	20	92,408	15	-34,045	-27	-5
Indust./Commerc.	1,775	--	2,982	--	1,207	68	--
Residential	12,372	2	26,793	4	14,420	117	2
Transportation	84	--	1,752	--	1,668	1,986	--
Public & Open	1,800	--	3,136	1	1,336	74	1
Mining & Waste			2,189	--			
WETLANDS:							
Open	7,434	1	11,373	2	3,939	53	1
Fresh	12,298	2	15,328	2	3,030	25	--
Salt							
TOTAL WETLANDS	19,732	3	26,701	4	6,969	402	1

TABLE TL-4
LAND USE IN BRISTOL COUNTY

Land Area Total: 368,398 acres

Population:	1950	1970	Change
	381,569	444,301	+16%

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	226,835	62	210,287	57	-16,098	-7	-5
Agricultural	73,701	20	56,134	15	-17,567	-24	-5
Indust./Commerc.	4,585	1	7,887	2	3,302	72	1
Residential	32,402	9	45,075	12	12,673	39	3
Transportation	514	--	5,204	1	4,690	912	1
Public & Open	4,801	1	6,390	2	1,589	33	1
Mining & Waste			4,098	1			
WETLANDS:							
Open	12,192	3	17,916	5	5,724	47	2
Fresh	9,911	3	7,245	2	-2,657	-27	-1
Salt	3,907	1	2,841	1	-1,006	-21	--
TOTAL WETLANDS	26,010	7	28,011	8	+2,001	8	+1

TABLE TL-5
LAND USE IN DUKES COUNTY

Land Area Total: 71,455 acres

Population:	1950	1970	Change
	5,033	6,117	+9%

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	48,526	68	48,745	68	219	5	--
Agricultural	14,892	21	9,991	14	-4,901	-33	-7
Indust./Commerc.	84	--	176	--	92	110	--
Residential	1,325	2	3,073	4	1,748	132	2
Transportation	161	--	175	--	14	+9	--
Public & Open	135	--	126	--	-9	-7	--
Mining & Waste			130	--			
WETLANDS:							
Open	5,024	7	6,394	9	1,370	27	2
Fresh	250	--	503	1	253	101	1
Salt	1,048	1	773	1	-275	-26	--
TOTAL WETLANDS	6,322	8	7,670	11	1,348	21	3

TABLE TL-6
LAND USE IN ESSEX COUNTY

Land Area Total: 336,023 acres

Population:	1950	1970	Change
	522,384	637,887	+22%

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	166,528	50	155,863	46	-10,665	-6	-4
Agricultural	74,364	22	41,174	12	-33,190	-45	-10
Indust./Commerc.	3,852	1	7,718	2	3,866	100	1
Residential	38,669	12	62,229	19	23,360	1[illegible]	7
Transportation	1,106	--	5,221	2	4,115	372	2
Public & Open	4,440	1	6,688	2	2,248	51	1
Mining & Waste			3,027	1	-		
WETLANDS:							
Open	14,539	4	19,301	6	4,762	+33	2
Fresh	12,772	4	10,502	3	-2,270	-18	-1
Salt	19,753	6	17,141	5	-2,612	-13	-1
TOTAL WETLANDS	47,064	14	46,944	14	-120	--	--

TABLE TL-7
LAND USE IN FRANKLIN COUNTY

Land Area Total: 465,455 acres

Population:	1950	1970	Change
	52,747	59,210	+12%

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	348,848	75	358,870	77	+10,002	3	2
Agricultural	92,376	20	65,598	15	-23,778	-26	-5
Indust./Commerc.	606	--	1,368	--	762	126	--
Residential	3,986	1	11,496	2	7,510	188	1
Transportation	413	--	2,047	--	1,634	396	--
Public & Open	820	--	1,921	--	1,101	134	--
Mining & Waste			1,055	--			
WETLANDS:							
Open	14,164	3	14,923	3	759	5	--
Fresh	4,242	1	4,117	1	-125	3	--
Salt							
TOTAL WETLANDS	18,406	4	19,040	4	634	3	--

TABLE TL-8
LAND USE IN HAMPDEN COUNTY

Land Area Total: 403,032 acres

Population:	1950	1970	Change
	367,971	459,050	+25

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	273,290	68	285,879	66	-7,411	-3	-2
Agricultural	82,452	20	51,020	12	-31,432	-38	-8
Indust./Commerc.	3,983	1	6,993	2	3,010	76	1
Residential	21,694	6	45,823	11	24,129	11	5
Transportation	1,758	--	5,970	1	4,212	240	1
Public & Open	5,049	1	6,122	2	1,073	21	1
Mining & Waste			2,358	1			
WETLANDS:							
Open	9,021	2	10,508	2	1,487	16	--
Fresh	5,785	1	3,448	1	-2,337	40	--
Salt							
TOTAL WETLANDS	14,806	3	13,956	3	-850	-6	--

TABLE TL-9
LAND USE IN HAMPSHIRE COUNTY

Land Area Total: 348,957 acres

Population:	1950	1970	Change
	87,594	123,982	+42%

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	240,376	69	243,957	70	3,581	1	1
Agricultural	84,086	24	61,897	18	-22,207	-26	-6
Indust./Commerc.	698	--	1,543	--	845	121	--
Residential	5,871	2	19,858	6	13,987	238	-1
Transportation	38	--	685	--	647	1,703	--
Public & Open	1,650	--	2,715	1	1,065	65	1
Mining & Waste			1,019	--			
WETLANDS:							
Open	11,612	3	10,970	3	-642	-6	--
Fresh	4,626	1	4,494	1	-132	-3	--
Salt							
TOTAL WETLANDS	16,238	4	15,464	4	-774	-5	--

TABLE TL-10
LAND USE IN MIDDLESEX COUNTY

Land Area Total: 540,564 acres

Population:	1950	1970	Change
	1,064,569	1,397,268	31%

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	296,998	55	280,275	52	-16,273	-6	-3
Agricultural	121,046	22	58,821	11	-62,2.5	-51	-11
Indust./Commerc.	8,113	2	17,291	3	9,178	113	1
Residential	64,803	12	114,986	21	50,178	77	10
Transportation	2,291	--	9,342	2	7,051	308	2
Public & Open	9,903	2	13,752	3	3,849	39	1
Mining & Waste			5,116	1			
WETLANDS:							
Open	13,518	3	16,320	3	2,802	21	--
Fresh	23,799	4	16,411	3	-7,388	-31	-1
Salt	88	--	50	--	-38	-43	--
TOTAL WETLANDS	37,405	7	32,781	6	-4,24	-12	-1

TABLE IL-11
LAND USE IN NANTUCKET

Total Land Area: 31,489 acres

Population:	1950	1970	Change
	3,484	3,774	+8

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	20,105	65	12,190	39	-7,915	-39	26
Agricultural	8,102	25	12,730	40	4,628	57	15
Indust./Commerc.	17	--	107	--	90	529	--
Residential	864	3	1,906	6	1,042	121	3
Transportation	221	1	226	1	5	2	--
Public & Open	46	--	122	--	76	166	--
Mining & Waste			160	1			
WETLANDS:							
Open	900	3	1,171	4	271	30	1
Fresh	494	2	538	2	44	9	--
Salt	740	2	708	2	-32	-4	--
TOTAL WETLANDS	2,134	7	2,417	8	283	13	1

TABLE TL-12
LAND USE IN NORFOLK COUNTY

Land Area Total: 261,059 acres

Population:	1950	1970	Change
	392,308	605,051	+54

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	153,994	59	135,744	52	-18,250	-12	-7
Agricultural	38,796	15	25,053	10	-13,743	-35	5
Indust./Commerc.	1,466	1	7,104	3	5,638	385	2
Residential	42,807	16	61,630	23	18,823	44	7
Transportation	692	--	4,084	2	3,392	490	2
Public & Open	3,956	2	4,957	2	1,001	25	--
Mining & Waste			3,550	1			
WETLANDS:							
Open	5,263	2	6,529	2	1,266	24	--
Fresh	11,594	4	6,847	3	-4,747	41	-1
Salt	1,491	1	937	1	-554	-37	--
TOTAL WETLANDS	18,348	7	14,313	6	-4,035	-22	-1

TABLE TL-13
LAND USE IN PLYMOUTH COUNTY

Land Area Total: 440,240 acres

Population:	1950	1970	Change
	189,468	333,314	+176

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	298,151	68	266,515	61	-31,636	-11	-7
Agricultural	72,151	17	49,910	11	-22,241	-31	-6
Indust./Commerc.	1,671	--	5,501	1	3,830	229	1
Residential	25,919	6	57,471	13	31,552	122	7
Transportation	185	--	4,490	1	4,305	2,327	1
Public & Open	2,528	--	5,201	1	2,673	106	1
Mining & Waste			3,570	1			
WETLANDS:							
Open	16,344	4	20,934	5	4,599	28	1
Fresh	15,152	3	14,508	3	-644	4	--
Salt	8,139	2	6,672	2	-1,377	-17	--
TOTAL WETLANDS	39,635	9	42,213	10	2,528	6	1

TABLE TL-14
LAND USE IN SUFFOLK COUNTY

Land Area Total: 38,158 acres

Population:	1950	1970	Change
	896,615	738,426	-18%

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	2,622	7	2,443	7	-179	-7	--
Agricultural	1,603	4	1,263	4	-340	-21	--
Indust./Commerc.	4,614	12	5,564	15	950	21	+3
Residential	15,076	39	15,478	40	402	3	+1
Transportation	3,713	10	3,883	10	170	5	--
Public & Open	7,330	20	3,760	10	-3,570	-49	-10
Mining & Waste			335	1			
WETLANDS:							
Open	1,559	4	1,890	5	291	18	1
Fresh	476	1	282	1	-194	-41	--
Salt	1,125	3	884	2	-241	-21	-1
TOTAL WETLANDS	3,200	8	3,056	8	-144	-5	--

TABLE TL-15
LAND USE TOTAL IN WORCESTER COUNTY

Land Area Total: 1,009,150 acres

Population:	1950	1970	Change
	546,401	637,969	+17%

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	672,498	67	693,209	69	20,711	3	2
Agricultural	220,364	21	134,998	13	-85,366	-39	-8
Indust./Commerc.	4,635	--	8.951	1	4,316	93	1
Residential	34,575	3	79,219	8	44,644	129	5
Transportation	803	--	7,335	1	6,532	813	1
Public & Open	8,069	1	10,718	1	2,649	33	--
Mining & Waste			5,951	--			
WETLANDS:							
Open	37,512	4	40,569	4	3,057	8	--
Fresh	30,694	3	21,796	2	-8,898	-29	-1
Salt							
TOTAL WETLANDS	68,206	7	62,365	6	-5,841	-9	-1

TABLES CZM-1 to CZM 9

MASSACHUSETTS COASTAL ZONE WETLAND AND ECONOMIC ACTIVITY SUMMARY, 1951-1971 BY COUNTY*

*Source: Coastal Zone Management Inventory

TABLE CZM-1
Changes in Coastal Wetlands by Type of Wetland* and Type of Activity
1951-1971: Barnstable County**
(Population Increase, 1950-70: +107%)

Wetland Acreage and Type of Activity	Change in All County Acreage	Acreage Change in Wetlands by Type					NET CHANGE
		TSM*	ISM*	DSM*	W*	WI*	
Wetland Acres							
1951		2,560	4,890	6,281	7,025	5,002	
1971		2,336	4,721	6,235	7,639	4,502	
Type of Activity							
Residential	+10,468	-8		-15	-1	-184	-214
Public works	+215					-7	-7
Commercial	+691		-6		-6	-16	-28
Industrial	+52					-2	-2
Transportation	+146					-17	-17
Mining	+153					+8	+8
Recreation	-668	-8	-8		-91	-81	-188
Agriculture	-8,517		-8	-11	+603	+214	+798
Forestry	-3,463	-208	-40	-16	-1	-410	-675
NET TOTAL	+613	-224	-62	-42	+504	-495	-325

*TSM = Tidal saltmarsh
ISM = Irregularly flooded saltmarsh
DSM = Irregularly flooded saltmarsh ditched (for mosquito control)
W = Fresh open water
WI = Inland freshwater wetland

**Barnstable County in Massachusetts consists of the following towns: Barnstable, Bourne, Brewster, Chatham, Dennis, Eastham, Falmouth, Harwich, Mashpee, Orleans, Provircetown, Sandwich, Truro, Wellfleet, Yarmouth.

TABLE CZM-2
Changes in Coastal Wetlands by Type of Wetland* and Type of Activity
1951-1971: BRISTOL COUNTY**
(Population Increase, 1950-1970: +7%)

Wetland Acreage and Type of Activity	Change in All County Acreage	Acreage Change in Wetlands by Type					NET CHANGE
		TSM*	ISM*	DSM*	W*	WI*	
Wetland Acres							
1951		355	396	2,109	2,404	1,035	
1971		600	348	2,112	2,359	884	
Type of Activity							
Residential	+1,247						
Public Works	+58				-1		-1
Commercial	+111						
Industrial	+395	-29			-6		-35
Transportation	+341				-6	-17	-23
Mining	+133						
Recreation	+354						
Agriculture	-2,632	+274	-10	+6	-27	-69	+174
Forestry	+72		-44	+4		-71	-111
NET TOTAL	+79	+245	-54	+10	-40	-157	+4

*TSM = Tidal saltmarsh
ISM = Irregularly flooded saltmarsh
DSM = Irregularly flooded saltmarsh ditched (for mosquito control)
W = Fresh open water
WI = Inland freshwater wetland

**Bristol County in Massachusetts consists of the following cities and towns: Acushnet, Berkeley, Dartmouth, Dighton, Fairhaven, Fall River, Freetown, Rehoboth, Somerset, Swansea, Westport.

TABLE CZM-3
Changes in Coastal Wetlands by Type of Wetland* and Type of Activity
1951-1971: DUKES COUNTY**
(Population Increase, 1950-70: +9%)

Wetland Acreage and Type of Activity	Change in All County Acreage	Acreage Change in Wetlands by Type					NET CHANGE
		TSM*	ISM*	DSM*	W*	WI*	
Wetland Acres							
1951		177	74	445	2,089	571	
1971		177	65	445	1,969	505	
Type of Activity							
Residential	+1,450						
Public Works	+20						
Commercial	+14						
Industrial	0						
Transportation	+34						
Mining	+51						
Recreation	+60		-9				-9
Agriculture	-3,710				-109	+7	-102
Forestry	+2,275				+5	-89	-84
NET TOTAL	+194		-9		-104	-82	-195

*TSM = Tidal saltmarsh
ISM = Irregularly flooded saltmarsh
DSM = Irregularly flooded saltmarsh ditched (for mosquito control)
W = Fresh open water
WI = Inland freshwater wetland

**Dukes County in Massachusetts is the Island of Martha's Vineyard and consists of the following towns: Chilmark, Edgartown, Gayhead, Gosnold, Oak Bluffs, Tisbury, and West Tisbury.

TABLE CZM-4
Changes in Coastal Wetlands by Type of Wetland* and Type of Activity
1951-1971: ESSEX COUNTY**
(Population Increase, 1950-70: +22%)

Wetland Acreage and Type of Activity	Change in All County Acreage	Acreage Change in Wetlands by Type					NET CHANGE
		TSM*	ISM*	DSM*	W*	WI*	
Wetland Acres							
1951		1,708	4,335	11,046	1,013	1,650	
1971		1,708	4,314	10,792	915	1,498	
Type of Activity							
Residential	+2,065			-8		-7	-15
Public Works	+172						
Commercial	+211		-5			-6	-11
Industrial	+95			-6			-6
Transportation	+246			-55	-16		-71
Mining	+398		-16	-127		-6	-149
Recreation	+230			-2		-27	-29
Agriculture	+1,264			-56	-133	+8	-181
Forestry	+127				+30	-93	-63
NET TOTAL	+4,808		-21	-254	+14	-131	-525

*TSM = Tidal saltmarsh
ISM = Irregularly flooded saltmarsh
DSM = Irregularly flooded saltmarsh ditched (for mosquito control)
W = Fresh open water
WI = Inland freshwater wetland

**Essex County in Massachusetts consists of the following cities and towns: Amesbury, Beverly, Danvers, Essex, Gloucester, Ipswich, Lynn, Manchester, Marblehead, Nahant, Newbury, Newburyport, Peabody, Rockport, Rowley, Salem, Salisbury, Saugus, Swampscott, West Newbury.

TABLE CZM-5
Changes in Coastal Wetlands by Type of Wetland* and Type of Activity
1951-1971: MIDDLESEX COUNTY**
(Population Decrease, 1950-70: -33%)

Wetland Acreage and Type of Activity	Change in All County Acreage	Acreage Change in Wetlands by Type					NET CHANGE
		TSM*	ISM*	DSM*	W*	WI*	
Wetland Acres							
1951			106**	137**	108**	30**	
1971			19**		38**	10**	
Type of Activity							
Residential	-25**		-3**				-3**
Public Works	+6**						
Commercial	-55**				-2**	-2**	-4**
Industrial	+122**		-15**	-6**	-5**		-26**
Transportation	+113**		-42**	-8**	-32**	-7**	-89**
Mining	+15**				-5**	-1**	-6**
Recreation	+36**			-7**	-2**		-9**
Agriculture	-76**		-27**	-83**	-55**	-10**	-175**
Forestry	+15**				-2**		-2**
NET TOTAL	+151**		-87**	-104**	-103**	-20**	-314**

*TSM = Tidal saltmarsh
ISM = Irregularly flooded saltmarsh
DSM = Irregularly flooded saltmarsh ditched (for mosquito control)
W = Fresh open water
WI = Inland freshwater wetland

**ALL MIDDLESEX COUNTY DATA ARE FOR A VERY SMALL PORTION OF THE COUNTY IN MASSACHUSETTS, CONSISTING ONLY OF THE CITIES AND TOWNS OF: Cambridge, Malden, Medford, Everett, and Somerville.

TABLE CZM-6
Changes in Coastal Wetlands by Type of Wetland* and Type of Activity
1951-1971: NANTUCKET COUNTY**
(Population Increase, 1950-70: +8%)

Wetland Acreage and Type of Activity	Change in All County Acreage	Acreage Change in Wetlands by Type					NET CHANGE
		TSM*	ISM*	DSM*	W*	WI*	
Wetland Acres							
1951		160	93	552	155	567	
1971		108	48	552	459	538	
Type of Activity							
Residential	+483						
Public Works	+48						
Commercial	+7			-7			-7
Industrial							
Transportation							
Mining	+70						
Recreation	+144				-38		-38
Agriculture	-1,118	-3	-45	+7	+282	-18	+223
Forestry	+188						
NET TOTAL	-178	-3	-45	0	+244	-18	+178

*TSM = Tidal saltmarsh
ISM = Irregularly flooded saltmarsh
DSM = Irregularly flooded saltmarsh ditched (for mosquito control)
W = Fresh open water
WI = Inland freshwater wetland

**Nantucket County in Massachusetts consists of the Island of Nantucket which constitutes the Town of Nantucket.

TABLE CZM-7
Changes in Coastal Wetlands by Type of Wetland* and Type of Activity
1951-1971: NORFOLK COUNTY**
(Population Increase, 1950-70: +28%)

Wetland Acreage and Type of Activity	Change in All County Acreage	Acreage Change in Wetlands by Type					NET CHANGE
		TSM*	ISM*	DSM*	W*	WI*	
Wetland Acres							
1951		44**	74**	891**	3**	79**	
1971		44**	74**	747**	--	81**	
Type of Activity							
Residential	+524**			-13**			-13**
Public Works	-142**						
Commercial	+58**			-2**		-1**	-3**
Industrial	+170**			-21**	-3**		-24**
Transportation	+48**			-37**			-37**
Mining	+9**			-2**			-2**
Recreation	+102**			-7**		-3**	-10**
Agriculture	-238**			-62**			-62**
Forestry	-263**					+6**	+6**
NET TOTAL	+268**			-144**	-3**	+2**	-145**

*TSM = Tidal saltmarsh
ISM = Irregularly flooded saltmarsh
DSM = Irregularly flooded saltmarsh ditched (for mosquito control)
W = Fresh open water
WI = Inland freshwater wetland

**ALL NORFOLK COUNTY DATA ARE FOR A VERY SMALL PORTION OF THE COUNTY IN MASSACHUSETTS, CONSISTING ONLY OF THE CITIES AND TOWNS OF: Braintree, Cohasset, Milton, Quincy, and Weymouth.

TABLE CZM-8
Changes in Coastal Wetlands by Type of Wetland* and Type of Activity
1951-1951: PLYMOUTH COUNTY**
(Population Increase, 1950-70: +107%)

Wetland Acreage and Type of Activity	Change in All County Acreage	Acreage Change in Wetlands by Type					NET CHANGE
		TSM*	ISM*	DSM*	W*	WI*	
Wetland Acres							
1951		577**	622**	5,137**	230**	1,316**	
1971		580**	556**	5,092**	240**	1,151**	
Type of Activity							
Residential	+2,997**		-13**	-5**		-50**	-68**
Public Works	+108**						
Commercial	+176**		-3**			-6**	-9**
Industrial	+81**						
Transportation	+172**			-11**		-16**	-27**
Mining	+58**		-11**	-13**			-24**
Recreation	+310**	-6**	-8**	-9**			-23**
Agriculture	-2,208**	+2**	-20**	+16**		+22**	+20
Forestry	-1,356**	+2**	-32**	-18**	+2**	-86**	-132**
NET TOTAL	+338**	-2**	-87**	-40**	+2**	-136**	-263**

*TSM = Tidal saltmarsh
ISM = Irregularly flooded saltmarsh
DSM = Irregularly flooded saltmarsh ditched (for mosquito control)
W = Fresh open water
WI = Inland freshwater wetland

**ALL PLYMOUTH COUNTY DATA ARE FOR LESS THAN HALF OF THE COUNTY IN MASSACHUSETTS, CONSISTING OF THE TOWNS OF: Duxbury, Hingham, Hull, Kingston, Marion, Marshfield, Mattapoisett, Norwell, Plymouth, Scituate, and Wareham.

TABLE CZM-9
Changes in Coastal Wetlands by Type of Wetland* and Type of Activity
1951-1971: SUFFOLK COUNTY**
(Population Decrease, 1950-1970: -18%)

Wetland Acreage and Type of Activity	Change in All County Acreage	Acreage Change in Wetlands by Type					NET CHANGE
		TSM*	ISM*	DSM*	W*	WI*	
Wetland Acres							
1951		18	280	757	276	87	
1971		18	241	627	16	50	
Type of Activity							
Residential	-3			-3		-2	-5
Public Works	+74				-9		-9
Commercial	+200		-1	-13	-26		-40
Industrial	+156			-1	-2		-3
Transportation	+191		-58	-67	-139		-264
Mining	+67			-26	-27		-53
Recreation	+35					-33	-33
Agriculture	-451		+20	-20	-57	-2	-59
Forestry	+109						
NET TOTAL	+378		-39	-130	-260	-37	-466

*TSM = Tidal saltmarsh
ISM = Irregularly flooded saltmarsh
DSM = Irregularly flooded saltmarsh ditched (for mosquito control)
W = Fresh open water
WI = Inland freshwater wetland

**Suffolk County in Massachusetts consists of four cities as follows: Boston, Chelsea, Revere, Winthrop.

TABLES 0-1 to 0-15

LAND USE AND ECONOMIC ACTIVITY SUMMARY FOR

15 SAMPLE MASSACHUSETTS TOWNS, 1951-1971*

*Source: MacConnell, Remote Sensing Data

TABLE O-1
LAND USE IN AMHERST

Land Area Total: 17,662 acres

Population:	1950	1970	Change
	10,856	26,331	142%

County: Hampshire

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	7,750	44	6,854	39	-876	-12	-5
Agricultural	8,422	48	5,757	33	-2,665	-15	-32
Indust./Commerc.	78	--	169	1	91	117	1
Residential	778	4	2,631	15	1,853	238	11
Transportation	--	--	--	--	--	--	--
Public & Open	382	2	676	4	284	77	2
Mining & Waste			123	1			

TABLE O-2
LAND USE IN BARNSTABLE

Land Area Total: 40,984 acres

Population:	1950	1970	Charge
	10,480	19,842	+89%

County: Barnstable

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	24,397	61	20,265	49	-4,132	-17	-12
Agricultural	6,582	16	3,522	8	-3,060	-46	-8
Indust./Commerc.	101	--	685	2	584	578	2
Residential	3,041	7	6,817	17	3,776	124	10
Transportation	126	--	862	2	+736	584	2
Public & Open	129	--	314	1	+185	143	--
Mining & Waste	--	--	297	1			

TABLE O-3
LAND USE IN BRAINTREE

Land Area Total: 9,100 acres

Population:	1950	1970	Change
	23,161	35,050	+51%

County: Norfolk

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	4,447	49	3,467	38	-980	-22	-11
Agricultural	897	10	352	5	-545	-61	-5
Indust./Commerc.	160	2	735	8	575	359	6
Residential	2,547	28	2,914	32	367	14	4
Transportation	51	1	274	3	223	437	2
Public & Open	201	2	355	4	154	77	2
Mining & Waste			88	1			

TABLE O-4
LAND USE IN CONCORD

Land Area Total: 16,536 acres

Population:	1950	1970	Change
	8,623	16,148	+87%

County: Middlesex

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	7,628	47	7,923	48*	295	4	1
Agricultural	5,375	32	3,060	18	-2,315	-43	-14
Indust./Commerc.	81	--	228	1	147	181	1
Residential	1,155	7	2,669	16	1,514	131	9
Transportation	86	--	205	1	119	138	1
Public & Open	159	1	399	2	240	150	1
Mining & Waste			94	1			

TABLE O-5
LAND USE IN FLORIDA

Land Area Total: 15,468 acres

Population:	1950	1970	Change
	479	672	+40%

County: Berkshire

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	13,528	87	13,340	86	-188	-1	-1
Agricultural	1,904	12	1,450	9	-454	-24	-3
Indust./Commerc.	--		49	--	49	--	--
Residential	--		290	2	290	--	2
Transportation	--		10	--	10	--	--
Public & Open	--		10	--	10	--	--
Mining & Waste			12	--	12	--	--

TABLE O-6
LAND USE IN NEWBURYPORT

Land Area Total: 6,616 acres

Population:	1950	1970	Change
	14,111	15,807	+12%

County: Essex

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1970 Number	1970 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	1,392	21	1,207	19	-185	-13	-12
Agricultural	2,155	33	1,205	18	-950	-44	-15
Indust./Commerc.	102	2	212	3	110	108	1
Residential	1,157	17	1,345	20	188	16	3
Transportation	24	--	126	2	102	425	2
Public & Open	154	2	206	3	52	34	1
Mining & Waste			101	2			

TABLE O-7
LAND USE IN PETERSHAM

Land Area Total: 43,460 acres

Population:	1950	1970	Change
	814	1,014	+25%

County: Worcester

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	31,140	72	31,168	72	28	--	--
Agricultural	2,957	7	2,158	5	-799	-27	-2
Indust./Commerc.	--	--	4	--	4	--	--
Residential	102	--	283	1	181	177	1
Transportation	--	--	4	--	4	--	--
Public & Open	25	--	22	--	-3	-12	--
Mining & Waste			7				

TABLE O-8
LAND USE IN SHEFFIELD

Land Area Total: 31,417 acres

Population: 1950 2,150 1970 2,374 Change +10%

County: Berkshire

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	17,951	57	19,785	63	1,843	10	6
Agricultural	11,581	37	8,574	27	-3,007	-26	-10
Indust./Commerc.	--	--	58	--	58		--
Residential	229	1	928	3	699	305	2
Transportation	3	--	60	--	57	1,900	--
Public & Open	19	--	91	--	72	379	--
Mining & Waste			83	--			

TABLE O-9
LAND USE IN SOUTHAMPTON

Land Area Total 18,912 acres

Population:	1950	1970	Change
	1,387	3,069	+121%

County: Hampshire

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	13,328	70	13,273	70	-55	--	--
Agricultural	5,364	29	3,937	21	-1427	--	-8
Indust./Commerc.	--	--	16	--	+16		
Residential	31	--	914	--	+883	2,848	--
Transportation	--	--	--	--	--	--	--
Public & Open	5	--	45	--	+40	800	--
Mining & Waste			38				

TABLE O-10
LAND USE IN TOPSFIELD

Land Area Total: 8,188 acres

Population:	1950	1970	Change
	1,412	5,225	+2,709

County: Essex

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	4,844	59	4,459	54	-385	-8	-5
Agricultural	1,990	25	1,154	14	-836	-42	-11
Indust./Commerc.	--	--	49	1	+49	--	--
Residential	302	4	1,294	16	992	328	12
Transportation	--	--	22	--	22		--
Public & Open	28	--	160	2	132	471	2
Mining & Waste			41	1			

TABLE O-11
LAND USE IN WESTPORT

Land Area Total: 37,036 acres

Population:	1950	1970	Change
	4,989	8,200	+64%

County: Bristol

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	21,344	58	19,827	52	-1,517	7	-6
Agricultural	7,960	21	7,031	13	-929	12	-2
Indust./Commerc.	54	--	222	1	+158	311	1
Residential	1,710	5	2,955	8	+1,245	73	3
Transportation	3	--	298	1	+295	9,833	1
Public & Open	145	--	185	--	+40	28	--
Mining & Waste			249	1			

TABLE O-12
LAND USE IN SANDWICH

Land Area Total: 28,484 acres

Population:	1950	1970	Change
	2,418	5,239	+116%

County: Barnstable

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	20,940	74	18,824	66	-2,116	-10	-8
Agricultural	3,160	11	2,063	7	-1,097	-35	-4
Indust./Commerc.	8	--	135	--	127	1,588	--
Residential	299	1	2,761	10	2,462	823	9
Transportation	313	1	311	1	-2	--	--
Public & Open	1,480	5	1,224	4	-256	-17	-1
Mining & Waste			199	1			

TABLE O-13
LAND USE IN WEYMOUTH

Land Area Total: 11,528 acres

Population:	1950	1970	Change
	32,690	54,610	+67%

County: Norfolk

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	4,635	41	4,219	37	-416	-9	-4
Agricultural	748	7	245	2	-503	-67	-5
Indust./Commerc.	381	3	430	4	49	13	1
Residential	3,923	34	4,364	39	441	11	5
Transportation	67	1	356	3	289	431	2
Public & Open	400	3	437	4	37	9	1
Mining & Waste			167	1			

TABLE O-14
LAND USE IN WILBRAHAM

Land Area Total: 14,260 acres

Population:	1950	1970	Change
	4,003	11,984	+199

County: Hampden

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	8,740	61	8,265	58	-475	-5	-3
Agricultural	4,251	30	2,270	16	-1,981	-47	-14
Indust./Commerc.	40	--	143	1	103	258	1
Residential	633	4	2,785	20	2,152	340	16
Transportation	5	--	18	--	13	260	--
Public & Open	123	1	165	1	42	34	--
Mining & Waste			186	1			

TABLE 0-15
LAND USE IN WHATELY

Land Area Total: 13,012 acres

Population: 1950 939 | 1970 1,145 | Change +22%

County: Franklin

TYPE OF LAND	ACRES OF LAND: 1951 Number	1951 Percent	1971 Number	1971 Percent	Change Number	Change Percent	Percent of Total Land Area
Forest	8,252	63	8,633	66	+381	+5	3
Agricultural	4,320	33	3,343	26	-977	-23	-7
Indust./Commerc.	--	--	18	--	18	--	--
Residential	73	--	433	3	360	493	3
Transportation	--	--	186	1	186	--	1
Public & Open	3	--	30	--	27		--
Mining & Waste			32	--			